VOLVME VI FEB. 1897 No. 2

# THE BRICKBVILDER

OFFICE 85 WATER STREET BOSTON

## THE BRICKBUILDER.

AN ILLUSTRATED MONTHLY DEVOTED TO THE ADVANCEMENT OF ARCHITECTURE IN MATERIALS OF CLAY.

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### PUBLISHERS' STATEMENT.

No person, firm, or corporation, interested directly or indirectly in the production or sale of building materials of any sort, has any connection, editorial or proprietary, with this publication.

THE BRICKBUILDER is published the 20th of each month.

IN our editorial column last month we took occasion to urge again the necessity of making common brick as well as pressed brick of the standard size, in order to do away with the unnecessary difficulties which the present unevenness of shape and improper proportions of most of the common brick put in the way of a general use of good bond in brickwork, and we pointed out that the reform we advocated would be certain to lead to a largely increased use of brick. There is a large field from which brickwork is now practically excluded, and in which it ought to be commonly employed, namely, our suburban architecture, and the practises we have been condemning are certainly among the causes which contribute to prevent the conquest of this important field by brick.

At the last monthly meeting of the Boston Society of Architects, Mr. Clipston Sturgis read a most interesting and suggestive paper in which he compared our suburban architecture, which is almost exclusively of wood, with recent suburban architecture in England, in which brick is generally employed. In the course of his paper he referred to the imperfect bonding of our brickwork, which must be improved if the use of brick is to become general, especially if 8 in. walls or hollow walls are used, which would be insecure unless thoroughly bonded. He emphasized especially the grave menace to the safety of all our great cities which exists in the easily inflammable wooden suburbs, by which they are on all sides surrounded. In these often large districts, more or less closely crowded with wooden buildings of the most inflammable character, a conflagration might start which the more solid masonry buildings in the heart of the city would be totally unable to resist. It is true that buildings in which the exterior walls only are of brick, and which have wooden floors and interior partitions, may easily be totally destroyed by fire, but it is a comparatively easy matter to prevent a fire in such a building from spreading to others in the neighborhood. It is true also that a conflagration of even limited extent will sweep away such buildings in its path almost as easily as if they were entirely of wood; but if *all* the buildings in a neighborhood had external walls of brick or other non-combustible material, no such conflagration would be likely to get under way. This is one reason why conflagrations are of so much less frequent occurrence in Europe than they are with us. It was shown that the expense of brick buildings need not be very much greater than those of wood. Moreover, if the use of brick was thus largely increased, brick would become still cheaper. The greatly increased demand would make it possible to sell bricks at a profit at prices much less than those which now prevail. Interior furring against brick walls can be done away with by using hollow-brick fire-proof furring blocks, which are now made of such a size that they can be bonded in with the brick. A very good wall is one built 8 ins. thick of brick, with a 1 in. air space and a 4 in. interior wall of fire-proof hollow bricks, bonded into the exterior wall. Such a wall has practically all the strength of a 12 in. wall, and is as dry as if furred on the inside with wood, especially if the air space is ventilated at the bottom into the celler, and at the top into the roof space, as can easily be done. Unfortunately, at present the building-laws of Boston and some other cities make the use of hollow walls unnecessarily expensive by refusing to count the inner lining as part of the effective thickness of the wall, when yet, if properly bonded, such a lining adds materially to the strength of the wall. The additional cost of the brick is fully offset by the greater permanence of the structure, by the saving in painting and repairs, and by saving in the insurance. It is a great mistake to suppose, as is sometimes done, that it is to the advantage of underwriters to have buildings that will burn up. All the efforts of insurance people have tended the other way. In a district in which structures having exterior walls and roofs of non-combustible material are the rule, and not the exception, underwriters can and will give more favorable rates on such buildings than where they are surrounded by highly inflammable structures. External ornaments of wood must, of course, be avoided if the advantage of the brick wall in point of safety against fire is to be preserved. Such wooden ornaments are nearly always ugly and are always unnecessary, especially now that manufacturers of molded bricks place such a variety of designs at the disposal of the builder.

But beyond the important questions of durability and safety lies the question of beauty. The best design in wood cannot equal the effectiveness of a good brick design. The wood always has an unsatisfying appearance of flimsiness and want of permanence. But our average wooden suburban house is uglier than it need be, and most of our suburbs are hopelessly depressing in their commonplace and often complacent vulgarity. There is certainly no substantial foundation for the feeling that there is anything unsuitable in the use of brick in the country, the feeling which regards it as something belonging to the city. That feeling, when it exists, arises solely from our having been so long accustomed, in our new country, to houses of wood, which have naturally persisted longer in the country than in the cities. There is a satisfaction in the look of permanence of a good country house of brick, and the warm, soft colors of a well-built brick wall nowhere are so beautiful as in a house embow-

ered in trees. We do not need to go to Europe to discover this. The country districts of Maryland, and Virginia, and portions of Pennsylvania still have fine old county seats of brick whose grouped chimneys and substantial-looking walls are most pleasant objects in the landscape.

The time, we believe, is not far distant when more substantial methods of building in our suburbs will be insisted upon, and brick-makers may find this important field preoccupied by other methods if they do not bestir themselves. We believe these are matters to which architects have not given as much attention as they should, and they might exert a great and salutary influence for the improvement of our suburban architecture.

## PERSONAL AND CLUB NEWS.

BENES & KUTSCHE, architects, Chicago, have removed from 63d Street to more spacious offices on the sixteenth floor of the Manhattan Building.

HARVEY L. PAGE AND STANFORD HALL, architects, have formed a copartnership under the firm name of Harvey L. Page & Co., with offices at Chicago and Washington, D. C.

MR. GODDARD has retired from the firm of Mills & Goddard, architects, Columbus, O., and connected himself with Peters, Burns & Pretzinger, of Dayton, O., as superintendent. Mr. Wilbur T. Mills will continue the business of the old firm.

THE new iron steamship being built by F. W. Wheeler & Co., Detroit, Mich., for the Bessemer Steamship Company, of New York, has been named by the owners the *W. L. B. Jenney*, as a mark of appreciation of the well-known Chicago architect's connection with the invention and introduction of lofty steel-skeleton construction of buildings.

THE exhibition of the Chicago Architectural Club has been postponed from March 2 to March 23. On the evening of February 15, Mr. George R. Dean, architect, read a paper on "The Evolutionary Position of American Architecture."

There were thirty-seven competitors this year for the Robert Clark Medal, the subject being "A Public Bath."

In awarding the silver medal the judges, Messrs. Louis J. Millet, Charles A. Coolidge, and J. K. Cady, were confronted with two designs of such nearly equal merit that they chose to make a new precedent and award two medals, one of which was their own contribution. The prizes were awarded as follows: Gold Medal, David G. Meyers, Boston, Mass.; Silver Medals, John F. Jackson, Buffalo, N. Y., and Oscar M. Hokanson, Philadelphia, Penn.; Bronze Medal, Arthur Shrigley, Lansdowne, Penn.; Honorable Mention, John F. Sheblessy and Thomas Livingston, Chicago, Ill.

THE regular monthly meeting of the St. Louis Architectural Club was held on the evening of February 6. President Ittner announced the committees and outlined the work for the year. Mr. Farish gave an interesting talk on "Cabinet Finish." A talk on "Hobos of the St. Louis Architectural Club in Rome," with lantern slides, was given by Mr. Fred Cox.

AT the regular monthly meeting of the Washington Chapter of the American Institute of Architects, held Jan. 8, 1897, the following officers were elected to serve during 1897:—

President, Joseph C. Hornblower; Vice-President, James G. Hill; Secretary, Edward W. Donn, Jr.; Treasurer, William J. Marsh; Committee of Admissions, Glenn Brown, W. M. Poindexter, J. R. Marshall. Mr. Eames, of Eames & Young, of St. Louis, was the guest of the evening. At the meeting held Friday, February 5, Mr. William Martin Aiken described the exhibition of the drawings of the American School of Rome, held in Philadelphia.

THE regular meeting of the New Jersey Society of Architects was held February 4, at the Board of Trade Rooms, Newark, N. J.

In an informal discussion regarding professional etiquette several instances of unprofessional practise were cited, and the practise of making promises to prospective clients which could not possibly be fulfilled were condemned. Several instances were cited in which the uniform contract between architects and owners, which was adopted some time ago by the society, were productive of much good in preventing misunderstanding with clients.

## BOOK REVIEW.

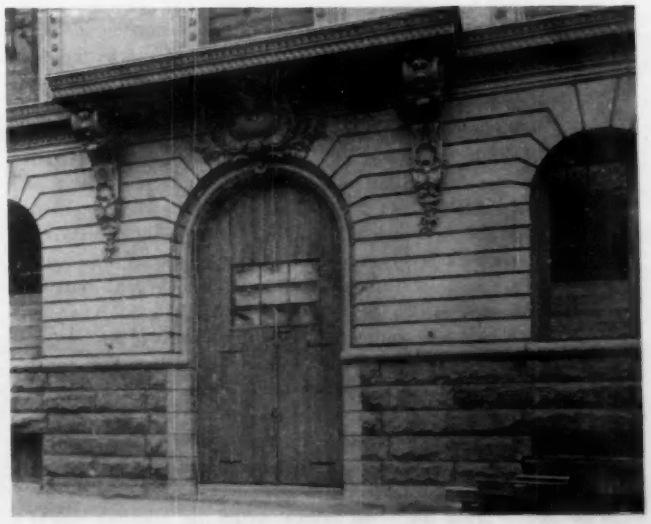
HOW to Build a Home "[1] is the title of a small book by F. C. Moore, who, from his experience and long observation as president of a large fire insurance company, is so abundantly able to give good advice on such a subject that his suggestions are well worth study. The book is sensibly written, with an appreciation of practical requirements and a refreshing absence of mere theory, containing the sort of advice one would expect from a friend who had built a house and knew what not to do and how to avoid it. Most people who build a house for the first time, if they employ an architect at all, are quite likely to be a bit afraid of him and his alleged extravagances, and not knowing really what they want, are loth to admit the vagueness of their expectations. It is to such that Mr. Moore's book will prove a boon, as it will enable them to understand the architect's plans, and avoid at least some of the faults which are sometimes overlooked by the most competent experts.

[1] "How to Build a Home. Being suggestions as to safety from fire, safety to health, comfort, convenience, durability, and economy." By Francis C. Moore, President of the Continental Fire Insurance Company, New York. Cloth, $1.00; paper, 50 cents.

## ILLUSTRATED ADVERTISEMENTS.

THE accompanying illustration shows the entrance to the Hamilton Club Building, Paterson, N. J., in which terra-cotta has been used with encouraging success from the level of the first story sill course. Mr. Charles Edwards is the architect, and the work was furnished by the New York Architectural Terra-Cotta Company.

In the advertisement of R. Guastavino, page xiv, is shown a



Guastavino System ceiling in one of the wards of the New Buffalo General Hospital, George Cary, architect.

In the advertisement of Charles T. Harris, Lessee, page xxvi, two views of the station for the Toledo & Ohio Central Railway Company, at Columbus, Ohio, are shown, Yost & Packard, architects.

F. B. Gilbreth, in his advertisement for this month, page xxxiv, illustrates the doorway of Casa de las Conchas, Salamanca.

# Italian Towers, IV.

BY C. HOWARD WALKER.

THE previous articles have shown examples of the most characteristic towers of Italy, from the earliest fortification tower type to the elaborated colonnaded type, represented by towers such as those of Chiaravalle and S. Gottardo, at Milan. There remains, scattered over Italy, two other varieties, each much more easily classified under an architectural style than those already mentioned, and yet both much more lacking in what can be truly called style. They are the Gothic and the Renaissance towers. Omitting Giotto's tower, at Florence, which is individual and like no other tower in existence, the Gothic towers of Italy, that is, the towers that attempt Gothic elaboration, are not especially attractive. The style never thrived on Italian soil. There was too conspicuous an environment of classic precedent, and climatic conditions did not tend to produce or to find acceptable the high peaked roofs and large openings of what is essentially an architecture of the Northland, suited to rains, and snows, and gray skies. With the close commercial ties that Italy had with Germany, and also from the fact that German mercenaries and free-lances constantly formed an important factor in the martial forces of Italian cities, it was most natural that the art of both Germany and France should have some reflex influence upon Italian architecture; but although there are distinctly Gothic churches in Italy, such as the Cathedral of Orvieto, and of Siena, the style had undergone a very manifest change, and instead of being sturdy, vigorous, expressing constructive conditions, and rich with masses of light and shades, its forms had become flattened, its constructive expression disappeared, and the Gothic style of Italy was a delicate veneer of lace-like forms, veiling the broad, simple walls of a Roman construction. It is manifest, then, that only the phantom of a Gothic art appears in Italy, always excepting the Gothic art of Venice, which is in truth an Oriental art, and that it is in the details that the Gothic style is plainly manifested. This detail is delicate and interesting. In most cases the masses of the buildings and towers are comparatively uninteresting.

STA. MARIA DELLA CROCE, CREMA.

The spire of the North becomes merely a steep, pointed roof in the South, and the four corner pinnacles are set on in such a fashion that it seems possible to remove them without affecting the integrity of the building, as they have little relation either in scale or in construction with the masses below. Of the Renaissance towers, little better can be said. In Venice Palladio and Sansovino erected plain, square, brick campanile, and terminated them with classic bell decks, surmounted by steep pyramidal or conical roofs. The design is simple and severe; the contrast of white marble between the red brick tower and the dark roof is excellent, and these towers are distinctive, distinguished, and the best of their class, in fact they are classic monuments elevated upon medieval shafts.

STA. MARIA IN STRADA, MONZA.

But when the pilaster treatment of the Renaissance style begins to make its appearance upon the successive stories of bell towers, the confusion of horizontal and perpendicular lines produces a very unsatisfactory result, and as the style begins to decay, inasmuch as novelty is sought for at the expense of good taste and proportions, the Renaissance towers become scarcely worthy of notice, occasionally amusing and interesting, and capable of being commended by that last of compliments, *i. e.*, that they would make good etchings, but scarcely be considered good architecture.

S. GIORGIO MAGGIORE, VENICE.

For it is very nearly axiomatic that any pronounced architectural form is at its best when treated with lines in the direction of its mass, and this is exactly what the Renaissance style with its superposed orders did not do when applied to towers. As a natural result, the worst of these towers are those which are elaborated the most, and the best are those like San Giorgio, in Venice, where architectural forms are confined to the termination of the towers, and to the natural efforescence of the shaft. These papers have by no means exhausted the list of Italian towers. They are merely intended to draw attention to typical forms, and it will be seen that the simpler their forms, the more nearly constructional, the more effective the towers become.

They are an absolutely distinct class by themselves, in no way partaking of the rich development of buttress, gable, pinnacle, and

spire characteristic of Northern work, and should not be compared with that work; but in their own way — rising in simple, clear-cut grace above the long horizontal roofs of Italian cities — they possess

CATHEDRAL, SIENA.

a charm of sincerity and of quiet dignity that we should be loth to lose.

CREMA. S. Maria della Croce, built between 1490 and 1515, by Giovanni Battista Battaglia, of Lodi, shows a mixture of Gothic tradition and influence of Bramante in the church of S. Maria della Grazie, in Milan. The tower suffers from two distinctly superposed orders, the lower cornice being as important as the upper, but the octagonal termination is well proportioned.

LORETO. The church was built early in the fourteenth century,

CHURCH OF SANTA CASA, LORETO.

and has been again and again enlarged. The dome is by Sangallo and Bramante; the façade and probably the tower by Calcagni, 1587; the upper part, with its bulbous termination, is by Vanvitelli. The tower is somewhat octagonal in plan, the upper portion badly proportioned to the lower. It has unnecessary pediments as ornamental features, and a most peculiarly uncouth spire, excellent in its color proportion, but awkward in form.

MONZA. S. Maria in Strada. Gothic church, dating from middle of the fourteenth century, with a very delicate Gothic dwarf tower, with very miniature corner pinnacles, delicate terra-cotta and brickwork, and beautiful window on the bell deck.

SIENA. Cathedral. The campanile, a simple, delicate, square tower of seven stages, was rebuilt in the fourteenth century by Agostino and Angelo da Siena. It is striated in white and black marble, and is a variation of the brick Lombard type with Gothic pinnacles. The spire is octagonal, of stone. It is a very beautiful tower.

STA. MARIA DELLA SALUTE, VENICE.

TURIN. La Superga, built in 1717–1730, by Juvara. Upon each wing is a rococo tower with bulbous spire, but in this case the pinnacles are so arranged that they serve to carry the line of form from the lower mass up into the spire successfully. This tower is

LA SUPERGA, TURIN.

excellently proportioned above the roof, but seems to need greater and higher substructure. It is, however, one of the best rococo towers in existence.

VENICE. S. Giorgio Maggiore, by Palladio, in 1565, with a very graceful, beautiful square brick tower with stone belfry, circular stone lantern above, and conical spire.

S. Maria della Salute, by Longhena, 1632, has two delicate campanile, of which the arched pediments and domed terminations harmonize with the great dome of the church, but are not successful in themselves.

## BRICK VAULTS BUILT WITHOUT CENTERS.

Translated from the "*Anales de la Construccion y de la Industria.*"

BY A. C. MUNOZ.

IN the province of Extremadura, Spain, timber is so scarce that in construction it becomes necessary to dispense with its use whenever possible, even in temporary supports such as centers for arches or vaults; as a result of this, almost all the brick vaults in that province have been built without the assistance of a center.

Several methods are in use, which differ but slightly from each other, and according to the kind of vault to be built. It may be said that all the different methods are based either upon the use of quick-setting mortar, or on taking advantage of the friction between the bricks and the mortar, to temporarily hold them in place until the mortar sets or until the vault is closed.

The vaults which depend on the quick setting of the mortar may be divided in two groups; in those of the first group the bricks are placed with one face tangent to the intrados curve, as in the Guastavino construction; in those of the second group, the bricks are placed with one side tangent to the intrados curve.

In the first group there are three methods of construction which are generally used for segmental barrel vaults, though semicircular ones, as well as groined and cloistered vaults, may be similarly constructed.

Fig. 1.

Fig. 2.

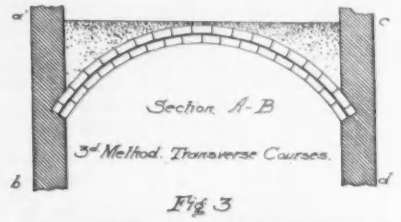
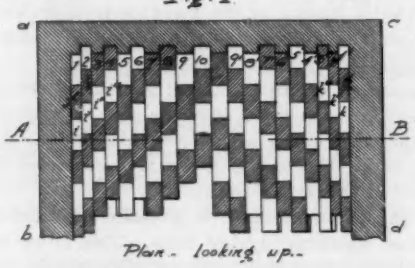
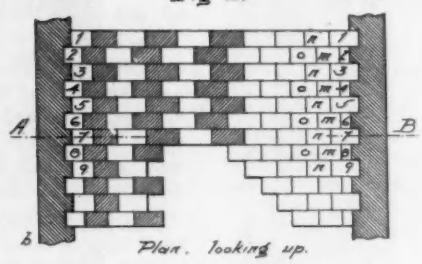
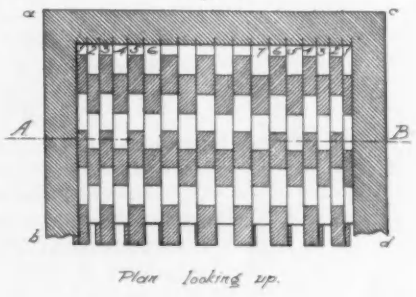


Fig 3


Plan - looking up.


Plan. looking up.


Plan looking up.

GROUP I. FIRST METHOD OF DIAGONAL COURSES.

In Fig. 1 let ab and cd be the side walls from which the vault springs, and a-c one of the head or end walls. A small groove determining the curvature of the vault is cut in the wall a-c and in the side walls ab-cd horizontal grooves are cut to receive the springers. It is preferable to form these latter grooves while the side walls are being built.

This done, the bricks and half bricks 1, 2, 3, 4, . . . 1′, 2′, 3′, 4′, are inserted in the groove on the wall a-c, in the above order, beginning at the two corners simultaneously and using quick-setting mortar. This first ring finished, the springers g and f and the brick h are laid; then, beginning always at the springing line, the diagonal courses i, i′, i″, i‴, and k, k′, k″ are built, resting each brick partly on the one previously laid and partly on two bricks of the previous diagonal course, the workman holding each brick until the mortar has set enough to support it.

Skillful workmen build these vaults by the eye, but for careful work it is better to guide the construction by means of strings stretched between the head walls, and determining the curvature of the intrados.

Should there be no head wall, the first ring 1, 2, 3, 4, . . . 1′, 2′, 3′, 4′, would have to be built over a center, but the diagonal courses would be built as in the previous case.

When the vaults are of great length they are usually divided into several sections by transverse arches and the sections vaulted separately but simultaneously, beginning at both sides of the transverse arches.

SECOND METHOD OF LONGITUDINAL COURSES. (FIG. 2.)

In this method, a groove having been cut or built in the side walls, the springing courses 1, 2, 3, 4, 5, on either side composed of bricks and half bricks is first constructed, and the following longitudinal courses are constructed by inserting the bricks m-m between every two projecting bricks of the springing course, and then by inserting the bricks n-n between the bricks m, and thus successively, working from both sides upwards until the vault is closed at the crown.

THIRD METHOD OF TRANSVERSE COURSES. (FIG. 3.)

In this method, as in the first, grooves are cut in the end wall and in the side walls. The first course consists of bricks and half bricks built into the grooves of the end wall a-c, and as in the second method, the following courses are constructed by inserting the bricks between every pair of projecting bricks of the previous course, thus forming a series of transverse courses.

These three varieties of vaults are useful when not intended to support a great weight, and are often used in building staircases. Their strength is increased by making them of two thicknesses of brick, in which case care should be taken that the joints of the upper arch do not correspond with those of the lower one. Also a good layer of mortar should be laid between the two arches.

The mortar used in the second arch need not be quick setting, as the lower one takes the place of a center.

When, as is most generally the case, chalk is used to make a quick-setting mortar, care must be taken not to close the vault until the mortar of the portion built has thoroughly set, for the reason that chalk increases considerably in volume while setting; and should the vault be closed at once, a thrust would be created at the springing of the arch which would either crack the supporting walls or the arch itself, and even destroy the latter.

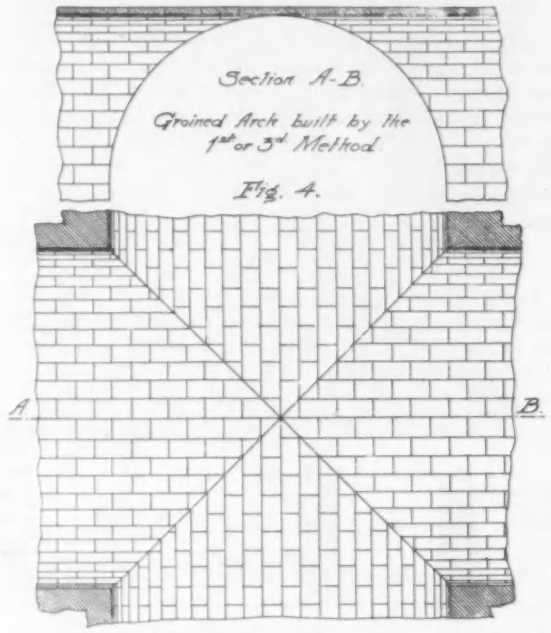
Cloistered and groined vaults are also built by the three methods described, the first and third methods being better adapted for groined vaults. At the groins or at any curves of intersection the bricks are cut to fit. In careful work it is better to determine accurately the curves of intersection and guide the construction by means of light wooden frames or strings.

Fig. 4 is a groined vault built by either the first or third method.

The method often used for ordinary brick vaults, in which the rows of brick are perpendicular to the groins, cannot be employed

when working without centers, as the joints would be helycoidal planes, and it would be impossible to give them by the eye their proper inclination at the different parts of the vault.

In all these vaults their stability depends on the thorough




adherence of the mortar and the bricks, which soon form a solid mass and reduce the thrust to a small quantity.

GROUP II. BRICK ARCHES AND VAULTS WITH "VERTICAL LEAVES."*

The difference between an ordinary arch and one of vertical leaves is that in the first the faces of the bricks are in planes radiating from the axis of the arch or vault, while in the second the bricks are laid with their faces in parallel planes perpendicular to the axis, thus forming a series of vertical leaves of the thickness of one brick.

The left half of Fig. 5 shows an ordinary arch, and the right half shows one of vertical leaves.

These vaults are built by cutting out on the end walls a channel or groove about ½ in. deep, and determining the curvature of the vault, the width of the channel being equal to the thickness of the vault, which may be half, one, one and a half, or two bricks. The first leaf is built by covering with quick-setting mortar one face of each brick, and the edges, forming the joints, and sticking them in place in the channel, beginning at the springing lines. The first leaf finished, the second and successive ones are constructed similarly, sticking the bricks against the previously built leaf and breaking joints.

When there is no end or head wall, an arch of three or four leaves is similarly constructed at each end with the aid of a light frame, after which the vault is built against these arches, as explained.

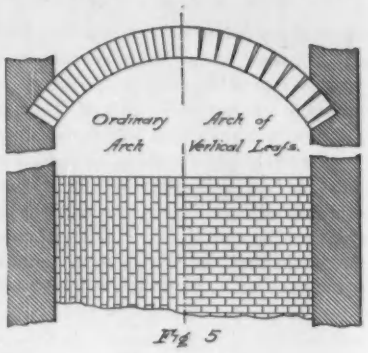
Vaults of this kind als depend, for their stability, on the thorough adherence of the mortar to the bricks, and on the quick setting of the mortar.

BARREL VAULTS WITH "INCLINED LEAVES." (FIG. 6).

These vaults are a modification of those just described, and in which the successive leaves are in parallel but inclined planes. In these, the use of quick-setting mortar is not required, as they depend on the friction between the bricks and the mortar for stability during construction.

* The word "leaf" is perhaps the best to use to express the idea of a series of thin arches made by the bricks, as in the construction to which the word applies; besides, it is the translation of the Spanish word "*hoja*" used in the original.

Vaults of this kind are generally composed of two distinct portions, the lower or springing portion, in Fig. 6, that between the lines ao-qo, forming the angle and the upper or crown portion that between the lines qo-q'o, forming the angle β.




The lower portion is constructed like an ordinary arch, but without using centers, the joints pq, at which this mode of construction stops, being determined by the angle of friction of the brick with the mortar, represented by α; for, while the inclination of the joints is smaller than this angle, there will exist frictional stability. Beyond this angle, however, frictional stability no longer exists, and to finish the vault centers would be required, unless the system of construction is changed.

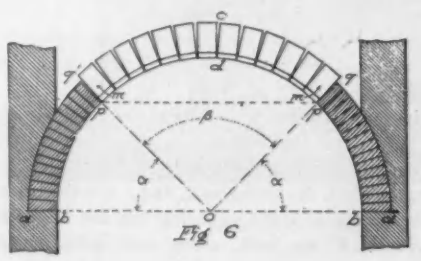
The required system for the upper portion of the vault consists in laying the bricks with their faces parallel to a plane having a given inclination (not greater than the angle of friction) and forming a series of inclined parallel leaves of the thickness of one brick.

One of these rings is shown in Fig. 7 in section and in side view by p' d' c', in Fig. 8, in plan by p d p, and in Fig. 6, in front view, by p q c-q' p d.

To construct the upper portion of the vault, an inclined channel, p q c-q' p d, Fig. 6, is cut out of the head wall. The bricks m-m are laid with their faces at an angle not greater than the angle of friction, one end of the brick being tangent to the curve of the intrados. Then the bricks 1-1', 2-2' (Fig. 7) are similarly laid until the first complete leaf 3-3' is formed.

The following leaves are similarly built, until the vault is closed at the opposite head wall, or, as is more often the case, the vault is closed at its center, the construction having proceeded from both head walls simultaneously. The closing leaves are constructed in different ways, as shown in Fig. 9, at A and B.

In this construction an outward thrust is produced against the head walls by the leaves which rest against them. This thrust is easily determined, considering how the forces act. The weight of the first or corner bricks m-m concentrated in its center of gravity resolves itself into two components, one parallel to the plane of the leaves, the other normal to it. The first is counteracted by the friction of the bricks with the mortar; the second or normal component presses against the head wall. Precisely the same occurs with all the bricks; and therefore the weight of any of the leaves forming the vault, resolved into its two components acting through the center of gravity of the leaf, will produce, first, a thrust parallel to the plane of the leaf and acting against the springing course m-m from where it is transmitted to the side walls, increasing the thrust due to the lower or springing portion of the vault; second, a thrust normal to the inclination of the leaves, which is transmitted to the next one, and so on for all the other leaves.




Thus, in Fig. 7, all the normal components to the left of the line m'-t', which is perpendicular to the inclination of the leaves, will act on the springing course m-m', while only those to the right of the line m'-t' will act on the head wall.

Representing the weight of the portion m' n' t' (Fig. 7) by W,

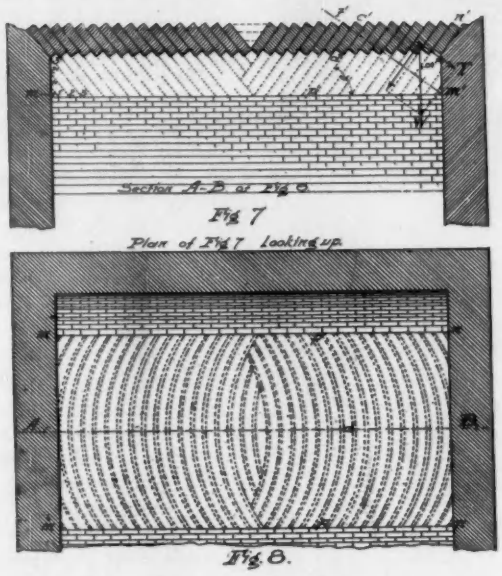
and the angle of the inclination of the leaves by $\alpha$, the thrust $T=W \cos. \alpha$ will act through the center of gravity of the portion m′ n′ t′. The stability of the head walls is determined by taking moments about a convenient point, as h in Fig. 9, by which is obtained the equation $Tl=W^1 \times \frac{x}{2}$ in which T is the thrust of the portion of the vault to the right of the line m′-t′ and acting through G, its center of gravity.

W′ is the weight of the head wall.

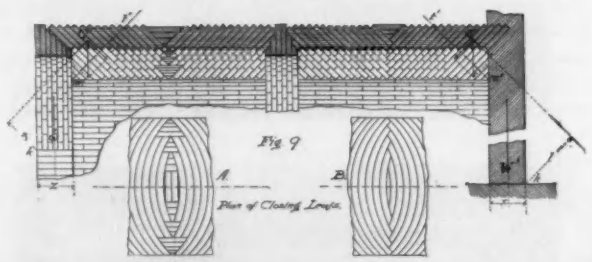
x is the width of the head wall.

l is the distance of the point h from the line of action of T.

If there is no head wall against which the first oblique leaves may be built, an arch is constructed by the ordinary method, using a




center, or by the method of "vertical leaves." The arch must be strong enough to resist the thrust, and its width is obtained from the equation $Ts=W_1 \frac{z}{2}$ (see Fig. 9), in which T is the thrust of the portion of the vault to the left of the line m″ t″; s is the distance of the




point k to the line of action of T; w′ the weight of the head arch, acting through its center of gravity; and z is the width of the head arch.

(*Will be concluded in March number.*)

## THE WEIGHT OF THE PARK ROW BUILDING.

NATHANIEL ROBERTS, M. Am. Soc. C. E., who is planning the steel construction for the new thirty-story office building on Park Row, New York City, of which R. H. Robertson is the architect, estimates the total weights of the building as follows: —

| | |
|---|---|
| Weight of building | 56,200 tons. |
| Weight of steel | 9,000 „ |
| Total | 65,200 „ |

The foundations will be laid at a depth commensurate with the height of the structure, the first stone course being 34 ft. 4 ins. below the sidewalk, while piles extend 20 ft. deeper still.

# Architectural Terra-Cotta.

BY THOMAS CUSACK.

(*Continued.*)

THE two Tuscan columns (Fig. 8) used on a window forming the central feature of the Sixth Avenue elevation of the Siegel-Cooper Building, New York City, being 1 ft. 10 ins. diameter, it was thought advisable to build them up in sections, a proposal to which the architects readily assented. The shaft is jointed horizontally into seven sections, and vertically into three segments, making a total of twenty-one pieces, in the setting of which the joints were broken every course. The base and capital are each in one piece; and though much larger than those used in the shaft, present no difficulty in making, because the slight variation in shrinkage (just enough to cause an eyesore at a flush joint) becomes inappreciable when the joint occurs at a projecting fillet. The general effect proved very acceptable, and amply justifies the means taken to obtain it. There are several other columns of a similar character used on this building, mostly on the tower, but the maximum diameter being 1 ft. 5 ins., some were made in five and others in six complete drums. They were handled in the manner described for Fig. 1, and when set in position appear to satisfy every requirement.

FIG. 11.

Thus far our remarks have applied exclusively to columns of the Doric, Ionic, Corinthian, and Tuscan orders. The examples cited may be considered merely as types of many hundreds that have been made with a fair degree of success, and of methods by which still greater success may be attained. They will, we hope, be sufficient to show that the difficulties by which the terra-cotta maker is beset, though onerous, are by no means insurmountable. The making of these columns requires mechanical skill of a high order, together with a special knowledge of clay, that comes best and surest to men who have had actual experience in handling, or opportunities of observing and studying its behavior under various conditions. Knowledge of this kind cannot be "read of in books, nor dreamt of in dreams." It must be acquired by very close and prolonged contact with the work, and some of it may be all the more effectual if absorbed, as Joey Ladle, the cellarman, was wont to receive his tipple, not by way of the throttle, but simply "taken in through the pores." Many and various are the expedients resorted to of a purely technical kind, in the several stages of manufacture, but all having the same object in view, viz: to counteract the ever-present tendency to warp, or sag, in the drying; and to promote uniform shrinkage in the blocks, as they pass through the final but inexorable ordeal of fire.

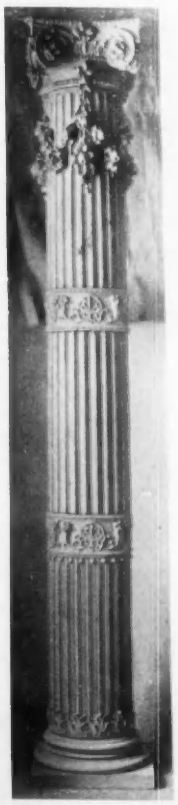


FIG. 14.

In columns of Saracenic, Byzantine, and late Romanesque char-

acter, few, if any, real obstacles will be encountered in their manufacture. The necessity for true alignment does not occur in them to the same extent; and the detail that may legitimately be introduced in the way of bands, spirals, zigzag flutings, lozenge, and diaper indentations of endless variety, serve to conceal such imperfections as may occur in the burning. The columns usually met with in Spanish Renaissance may likewise be included in this category. The Oriental richness of detail introduced, first by the Arabians, and then by the Moors, becoming assimilated with Italian outlines, produced a phase of Renaissance that is well within the limit of terra-cotta construction, and admirably fitted for plastic enrichment. The methods adopted in the case of previous examples will serve for them also, subject to such modifications as may fit in with particular circumstances.

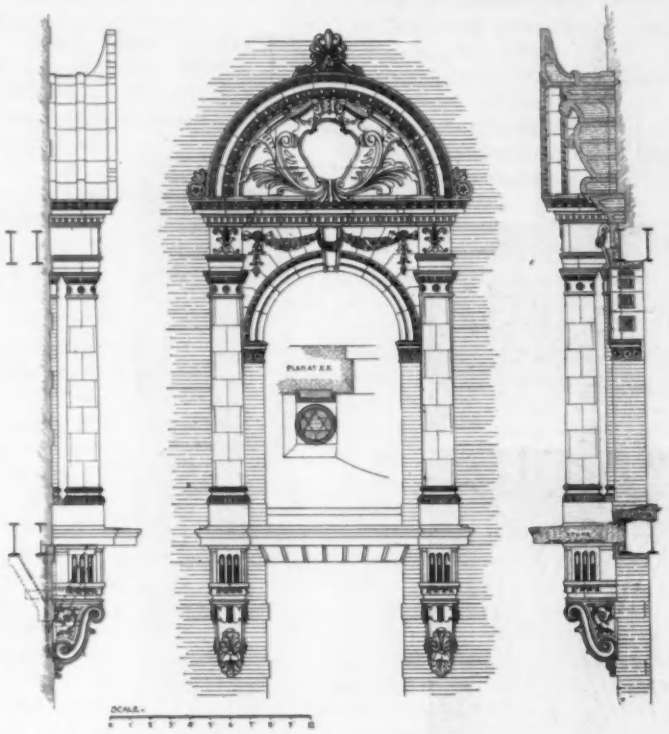


FIG. 8.

The parting of the ways between the French Renaissance of native growth and that previously introduced from Italy by Vignola and Serlio, found expression in the work of Delorme and other architects towards the close of the sixteenth century. The earlier portion of the Louvre, the Chateau d'Anet, and the Tuileries showed a divergence in many things, the most notable innovation among them, from the present point of view, being the rusticated pier and pilaster bands; and in admirable keeping with these followed columns (Figs. 9 and 10) into which were introduced bands of a more ornamental character, alternating with the fluted drums. These bands having but little projection, and adhering closely to the entasis of the column, did not in any way mar its outline. The idea of strength and vigor was thus obtained, without any sacrifice of grace, and when it was thought desirable to still further subdue the severity of the flutes, this was done by a husk, a ball-flower, or a diminishing drop ornament. These features could not have been introduced with any view to the use of terra-cotta, for the examples quoted were all executed in stone; but had such really been the intention, no device, however deliberate, could have more completely subserved the end in view. There is hardly anything within the wide range of its application to architectural purposes so ideal in point of fitness, and yet so well within the scope of economical execution. At any diameter up to two feet the drums and bands would be made in single blocks, being compact in form, and of convenient size for handling, with no troublesome projections to care for, nor salient angles to crack by premature or unequal drying. If much above that size they would be made in quadrants, the drums being jointed on the axis, while the bands would break joint on the intermediate angles, as in Fig. 11. A pair of these columns, designed by Messrs. Nolan, Nolan & Stern, of Rochester, were used by them on the Chamber of Commerce Building, recently erected in that city. In this case they are built around a steel core forming part of the structural support of a twelve-story building, of which we may have something to say when dealing with cornice construction. Columns of this character are, of course, susceptible to any suitable style, or degree of ornament, and may be varied in detail by modeling two alternating bands. These may again be multiplied by varying the central feature of the design on each of the four sides, and then by merely turning them on their axis in the setting, it would be possible to get eight different combinations when viewed from any one standpoint. Something of this kind is done in the columns of two very beautiful windows on the New Street front of the Manhattan Life Building, New York (Fig. 12). The chief thing to regret in that case is that they are situated on the sixth story, and are therefore doomed to blush unseen, wasting much of their sweetness on the preoccupied denizens of the Stock Exchange. The faces, however,

FIG. 9.

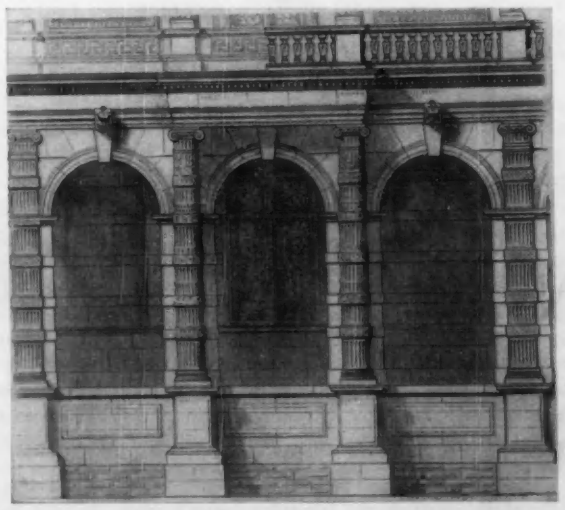


FIG. 10.

are clearly defined and artistically finished, and would stand critical inspection if used for interior work. This is a very modern building in construction and appointments, and in these respects represents modern ideas, but it will be seen that the architects did not allow the terra-cotta contractors to forget that: —

> "In the elder days of art,
> The builder wrought with wondrous care,
> In the unseen and hidden part,
> For the gods see everywhere."

The late Richard M. Hunt, just fresh from the Beaux Arts, gave to columns of this class a fitting introduction some forty years ago in one of his first works in New York City. They were made the chief distinguishing feature in the design of a residence on the north side of 38th Street, a little west of Fifth Avenue. At a later

FIG. 12.

date some "archieteck" undertook to imitate this house; which he did in a particularly tame and colorless caricature, built on the abutting lot to the west. The lapse of time has not, in this case, been favorable to the survival of the fittest, for while the work of the architect has been torn down and rebuilt (perhaps in disgust), that of the copyist remains, a forlorn relic of fading gentility.

The original banded column used on the Louvre (Fig. 9), has since been modified on the one hand and emphasized on the other, in conformity with varying needs, and in keeping with widely different environments; but it has stoutly maintained its place as a distinct type in competition with, and often by preference over, other styles. If this has been so in the case of stone, where most of the laborious work and all of the carving must necessarily be done by hand, as distinguished from machine labor, there are obviously great advantages in the substitution of a material that can be molded into shape and finished by the modeler while in a plastic state. It is seldom that less than one pair of columns are required, but even with this number, the preliminary expense of models and molds, added to that of all other labor and material, will be less than half the cost of stone. With a greater number the relative difference in cost becomes more than proportionately large, because the set of molds necessary for one will, if need be, produce from thirty to forty columns.

In Fig. 13 we have one of eight very elaborate and yet appropriately enriched columns, used on the handsome new City Hall, Elmira, now approaching completion. Four of them support a pediment on the Church Street elevation, and the other four carry a similar pediment on Lake Street. The background of the shaft at its greatest diameter is 2 ft. 6 ins., diminishing to 2 ft. 2 ins. at the neck, from which the bands have a uniform projection of 1 in. The ornament is of necessity in very low relief, but so crisp in definition that its main outlines are legible at some distance. The drums are in quadrants, breaking joint with each other, and with the bands, which are also jointed in four pieces, leaving in each case an opening in the center, to be built solid in brick and cement. The making of these columns was capable of being simplified to such an extent that out of 16 molds of a convenient size was got 32 presses from each, or a total of 512 pieces, duly entasized, and requiring little, if any, fitting when taken from the kiln. The large capitals are each made in eight pieces, with joints that are practically invisible, and the Renaissance feeling infused into the Corinthian order is in complete harmony with all the ornament on the building. We do not hesitate to challenge comparison between these capitals and any of the contemporaneous examples in stone, which have been spoken of as exhibiting the highest attainable excellence in nineteenth century stone carving.

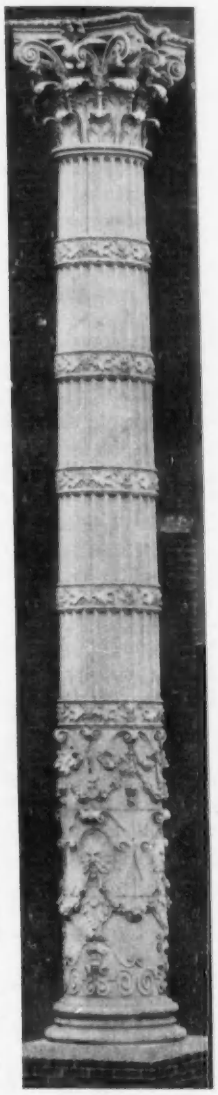


FIG. 13.

Two other columns (Fig. 13), smaller in size but of similar design, are used in the vestibule of the Church Street entrance, which is wholly in terra-cotta. This apartment, though not large, is exceedingly ornate. To each side of the columns stand paneled pedestals, carrying richly modeled pilasters and capitals, supporting an enriched architrave, festooned frieze, and cornice. Two niches have been thoughtfully provided in this vestibule by the City Fathers, in which, perhaps, to immortalize, at some later date, the more deserving of their number.

Columns of other sizes and designs might, of course, be added by way of illustration; but as they would be merely variations of those already given, their methods of construction would be determined by considerations such as have been stated. We have pointed out the chief difficulties that arise in the process of manufacture, and the extent to which, as well as the means whereby, these may be minimized, or wholly overcome. Where architects are willing to keep their demands within reasonable limits, and manufacturers ready to adopt such progressive methods as a riper experience may suggest, both can look forward to correspondingly successful results.

*(To be continued.)*

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No good building was ever yet erected in which the architect designed the front, and left the flanks or internal courts to take care of themselves. So, also, no good building was ever seen in which the exterior only was thought of, and the internal decoration and design neglected. — *Street.*

# Fire-proofing Department.

## SOME VALUABLE OPINIONS ON FIRE-PROOF CONSTRUCTION.

CONTINUATION OF A SERIES OF INTERVIEWS WITH PROMINENT ARCHITECTS IN NEW YORK AND BOSTON, ON THE VALUE OF TERRA-COTTA AS A FIRE-PROOFING MATERIAL.

IN an interview upon the subject with Mr. John M Carrère, of Carrère & Hastings, New York, he stated that in his practise he has never had occasion to use anything except terra-cotta for fire-proofing purposes. He considers the material the best in the market, but the mechanical details of construction and the methods of setting in place leave considerable to be desired, and as usually employed around a building it is difficult to get a thoroughly workmanlike job. Burnt clay is perfectly reliable and can be depended upon for ample protection to the structure, but it is often not used to the best advantage; and where, as is usually the case, the handling and setting of it has to be entrusted to absolutely unskilled labor, it is not strange that the results should leave a good deal to be desired. Fire-proofing has become so much of a science that it could with great advantage be left to experts, whose advice and cooperation would be welcomed by architects and contractors; and, indeed, if the manufacturers of terra-cotta are to retain their hold on the confidence of the public, Mr. Carrère believes it would be highly desirable that they should insist upon either setting their material in the building, or at any rate that the individual manufacturers should follow the terra-cotta after it is delivered at the building, and should personally satisfy themselves that it is used in the right manner, notifying the architect whenever it is improperly applied or put up in a bungling manner. In this way a great deal of the mechanical objection to terra-cotta blocks could be obviated. Mr. Carrère says this is precisely what has been done by manufacturers of other lines of building materials, such as the patent wall plasters, for instance, the manufacturers of which found it absolutely necessary to control the mixing of the plaster, and to supervise the application to the walls of the finished product in order that the material should not be misrepresented or misapplied, and the leading manufacturers of these goods make a business of reporting constantly to the architects any improper use of their material. Often when the specification for terra-cotta fire-proofing is well written and comprehensive an architect cannot be sure that the best use is made of it. A more scientific treatment of terra-cotta is needed.

Mr. Carrère advocated a more thorough fire-proofing of the columns in a building. The casings for such work should be heavier than is usually employed for this purpose, and should be interlocking, so that in case of partial damage by fire or water the blocks will not become loose. He thought possibly two casings would be better still, so the outer one, if peeled off by accident, would not expose the column. He thought also that the spaces about a column and also all chases left in walls for pipes, or about beam ends, should be thoroughly filled with terra-cotta, so as to leave no opportunity for flues in the wall through which fire might be led. In fact, his feeling was that while the system of fire-proofing with terra-cotta blocks is excellent, it is often not carried far enough, and terra-cotta is used too sparingly about a building to make it what could be called absolutely fire-proof. This is a pretty serious condition, as it leads to over-confidence on the part of the tenants, and when trouble comes, as it is very likely to in the long run, the whole system is apt to be condemned, whereas it is really the fault of the way in which it is used. He also spoke of a very common practise in regard to repairs around large buildings, which, though constructed with the utmost care by the architect and builder, are placed in the hands of an agent who may have little interest in architecture and less knowledge of the actual construction. The fire-proofing may then be cut out most recklessly, and where blocks or sections of floors are removed for changes or repairs the fire-proofing is not put back in a first-class manner, a bit of mortar or some so-called fire-proofing paper often being made to answer a purpose which could only be properly accomplished by a thorough replacement of the terra-cotta blocks.

Mr. Carrère was asked if he considered a stone facing a sufficient protection for columns which are built into exterior walls. In his judgment, the custom of building a steel frame and facing it with a relatively thin casing of stone on the outside is not only not fire-proof, but is really criminal in that it does not afford sufficient protection to the steel. There are numerous examples of just such species of construction in New York in which in some cases granite, which has all the appearance of solid blocks, is so cut away to receive columns that only 2 or 3 ins. separates the exterior surface of the wall from the metal, which is consequently protected by no external fire-proofing whatever. In case of fire this stone would be pretty sure to fly to pieces and the columns would be left bare. If circumstances render the use of stone imperative it is better that the column be made entirely free, set in from the wall and fire-proofed throughout with terra-cotta blocks, in addition to the stone facing. Mr. Carrère saw no reason why walls as well as floors and partitions should not be built of terra-cotta, and he instanced one prominent building in New York in which the system of steel construction is carried to its logical conclusion. The steel skeleton is constructed in the usual manner and is then filled in between the exterior portions with steel bars set at close intervals, the exterior facing of the building being of finished terra-cotta, while the backing and all the fire proofing is of the ordinary terra-cotta blocks such as are used for partition work.

A vital issue that is often neglected is the arrangement of the rooms themselves in a building quite as much as the details of fire-proofing. We ought to build more on the compartment system, and the stairs, which are a vulnerable portion of the structure and are usually built of iron not enclosed nor fire-proofed at all, should be either cased throughout in terra-cotta, or, better, regularly constructed of terra-cotta or tile without the use of steel at all.

Mr. Carrère called attention to a construction which is often found in buildings in which the steel work forming the soffits of window and door openings is left without any protection whatever. A building cannot be called fire-proof while any stone or iron is so used that it can be affected by heat or water, and terra-cotta in some form should be used to protect the openings of the doors quite as much as the floors. He suggests an improvement in the forms of floor blocks, which are customarily made to lap under the flanges of the beams with a thickness of about 1 in. of terra-cotta. The blocks so formed are probably ample for any required protection to the iron, but the pieces which lip under the beam are so often poorly set or broken in the setting that he thinks it would be better to have at least 2 ins. instead of 1 for the flange under the beam.

Mr. Winslow, of Winslow & Wetherell, Boston, when interviewed, stated that he considered terra-cotta itself thoroughly fire-proof and that fire-proofing results are only a question of thickness of material and the manner of application. For that matter, good terra-cotta is nothing but brick, and brick is generally conceded to be the best and most thorough protection against fire, though the weight of brick precludes its suitable employment for thick floors. We may be able to trust other constructions, but we know we can trust terra-cotta, and in the present state of the science there is nothing so satisfactory. He cited the instance of the Pope Building, Boston, which was recently destroyed by fire. Had it been constructed of stone or any other material than terra-cotta and brick, there would have been nothing left of it, and though, owing to the fact that the floor construction was entirely of wood, the building was virtually destroyed, the brick and terra-cotta amply demonstrated their capacity to resist the action of heat.

Mr. Winslow said that in the so-called fire-proof building as actually built the real protection is usually not carried sufficiently far. In any office building, for instance, there is enough wood about the

floors and the finish, to say nothing of the contents, to make a very considerable fire if it once caught, and he would prefer to see a building in which all inflammable material of this sort was eliminated, so that, at the most, nothing but the contents could be consumed. In one of the large buildings recently constructed by his firm, a fire started in one of the rooms after it was all finished and ready for occupancy, the fire being caused by spontaneous combustion from painters' rags. The doors, windows, and portions of the floor were almost entirely consumed, but the fire simply burned itself out.

Winslow & Wetherell used hard terra-cotta in the construction of the large Tremont Building just completed. They have used elsewhere the porous terra-cotta, and are at present employing it in the Hotel Touraine, now in process of erection. They have found that the hard terra-cotta is quite brittle and is apt to break and crack in setting, and in practise they prefer the porous terra-cotta.

For partitions they have never felt inclined to use anything but terra-cotta blocks, nor would they care to make any experiments with any other forms which have been offered to them. They consider that the terra-cotta blocks make a perfectly straight construction, and their experience leads them to believe that it will resist with perfect satisfaction the action of both fire and water. For furring on outside walls Mr. Winslow employs porous terra-cotta blocks. He has tried hollow brick, but on account of the brick being in itself not so strong as the ordinary hard-burned brick, he does not favor such employment and would prefer terra-cotta. Around columns, his practise has been always to fill in solidly with terra-cotta blocks, and where the column is hollow to fill the interior solid with cement concrete, applying a thickness of metal lathing and plastering outside of the whole. The fire-proofing of columns he considers a good deal of an open question, however, and feels that existing methods could be considerably improved upon in this direction. In regard to girders, he believes that if the webs are thoroughly encased and bedded with terra-cotta blocks, and the bottom flanges covered with metal lathing and plastering, no heat in a burning building, even though it might penetrate the plaster envelope, would be able to affect the steel, as the terra-cotta blocking beside it would take up the heat before it could act upon the metal.

As a matter of stability he considered terra-cotta floor blocks an excellent lateral brace. In the construction of the Hotel Touraine he began to have the floor blocks built in as the iron work was carried up, but has discontinued the setting of the blocks until all steel work is in place, as he believes the vibrations from the handling of derricks, etc., would tend to impair the set of the fire-proof work; but when the floor blocks are once in place nothing that will ever come in the building, in his judgment, will ever dislodge them or even unduly strain them. The most potent objection to the use of terra-cotta is the great weight which it necessitates per foot. For a low building this does not aggregate very much of a load upon the columns and foundations, but even admitting the question of weight, he would prefer to use terra-cotta blocks throughout on account of the added lateral strain. He cited the thirty-story building which is now under construction in New York, on Park Row, from plans of Mr. Robertson, representing, in some respects, the latest work in tall building construction, which, according to recent reports, is to be fire-proofed throughout with porous terra-cotta end construction floor blocks. Undoubtedly, all the various systems in the market were considered in connection with this building, but the fact that terra-cotta has been used instead of anything else is pretty good evidence that the material is satisfactory to those who have had most experience therewith. The setting in place of fire-proofing terra-cotta should not, however, be entrusted to careless or ignorant builders.

Mr. Winslow concluded that when you come right down to the broad work of fire-proofing a structure, he did not think anything was better than terra-cotta in its various forms. In England, the employment of terra-cotta has been constantly increasing of late years, which is ample evidence of how it is regarded in that part of the world.

# Mortar and Concrete.

## AMERICAN CEMENT.

BY URIAH CUMMINGS.

### CHAPTER VII.

### CEMENT TESTING.

(*Continuation of tests made by Prof. Cecil B. Smith.*)

### SERIES V.

EVAPORATION AND CRUSHING TESTS AND EVAPORATION AND TENSILE TESTS.

(*a*) *Evaporation and crushing tests.*

This series had for its first intention, information on the comparative and actual amount of evaporation of moisture from different mortars made with different cements, but it soon developed into an endeavor to obtain some relation between crushing strength and evaporation. Any law on the matter, if there is any general law, will of course take years to demonstrate; but enough has been done to show that any investigations on this subject will be fruitful of results. The method of procedure was as follows: Mixtures were kept in damp air 30 days, then immersed 2 days in water of ordinary temperature, then taken out and weighed; they were then kept in the warm dry air of the laboratory at a temperature of about 65 degs. Fahr. exactly 2 days, when they were again weighed and immediately crushed. The experiments recorded in Table IX. were all made on 2 in. cubes, and 2 days was established, because it was found that at that time the evaporation was practically complete. Other experiments (not recorded) made on 3 in. cubes gave less evaporation per cent. and also less strength. Attached to this are three diagrams; the first two show strength and evaporation in different mixtures and with five brands of cement. The third diagram is the product of the other two, and is quite worthy of inspection, because it would appear from it that it would be possible to estimate fairly and accurately, without actually crushing a specimen, what load it would bear.

TABLE IX.

EVAPORATION AND CRUSHING TESTS.

No. 11 — PORTLAND.

SERIES V.

| Mixture. | Evap. per cent. in 2 days. | Crushing strength per square inch. | Product. | Max. wt. of 2 inch Cube. | $\left(\frac{s}{\sqrt{\text{wt.}}}\right)^2$ | Column 4 divided by column 6. |
|---|---|---|---|---|---|---|
| | | | | oz. | | |
| Neat. | 1.48 | 3925 | 5809 | 10.43 | 22.16 | 262.1 |
| 1 to 1 | 3.41 | 2211 | 7539 | 10.12 | 21.71 | 347.3 |
| 2 to 1 | 6.20 | 1031 | 6492 | 9.39 | 20.66 | 314.1 |
| 3 to 1 | 10.39 | 544 | 5652 | 9.14 | 20.30 | 278.4 |
| 4 to 1 | 11.49 | 431 | 4952 | 8.92 | 19.97 | 247.9 |

No. 10 — PORTLAND.

| Mixture. | Evap. per cent. in 2 days. | Crushing strength per square inch. | Product. | wt. | $\left(\frac{s}{\sqrt{\text{wt.}}}\right)^2$ | Column 4 divided by column 6. |
|---|---|---|---|---|---|---|
| Neat. | 0.97 | 4367 | 4231 | 9.84 | 21.31 | 199.0 |
| 1 to 1 | 2.20 | 3062 | 6736 | 10.23 | 21.87 | 308.0 |
| 2 to 1 | 5.59 | 1079 | 6032 | 9.43 | 20.72 | 291.1 |
| 3 to 1 | 8.61 | *940 | 8093 | 9.15 | 20.31 | 398.4 |
| 4 to 1 | 11.68 | 504 | 5886 | 8.86 | 19.87 | 296.2 |

* One day older than others.

No. 3 — PORTLAND.

| Mixture. | Evap. per cent. in 2 days. | Crushing strength per square inch. | Product. | wt. | | |
|---|---|---|---|---|---|---|
| Neat. | 4.65 | 1863 | 8662 | 10.00 | 21.62 | 400.7 |
| 1 to 1 | 4.10 | 1875 | 7687 | 10.12 | 21.71 | 354.1 |
| 2 to 1 | 5.67 | 1417 | 8034 | 9.60 | 20.97 | 383.1 |
| 3 to 1 | 8.11 | 687 | 5572 | 8.95 | 20.01 | 276.2 |
| 4 to 1 | 12.56 | 412 | 5176 | 8.88 | 19.90 | 260.0 |

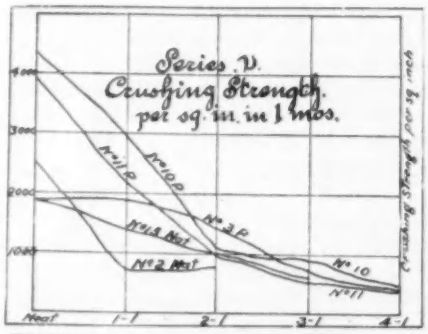
No. 15 — NATURAL.

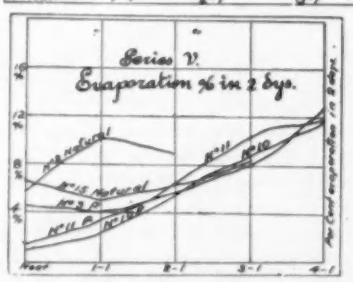
| Mixture. | Evap. per cent. in 2 days. | Crushing strength per square inch. | Product. | wt. | | |
|---|---|---|---|---|---|---|
| Neat. | 6.76 | 1888 | 12762 | 9.40 | 20.67 | 617.4 |
| 1 to 1 | 5.08 | 1437 | 7300 | 9.65 | 21.02 | 347.3 |
| 2 to 1 | 6.12 | 988 | 6046 | 9.32 | 20.57 | 293.9 |
| 3 to 1 | 8.34 | 575 | 4796 | 9.05 | 20.16 | 237.9 |

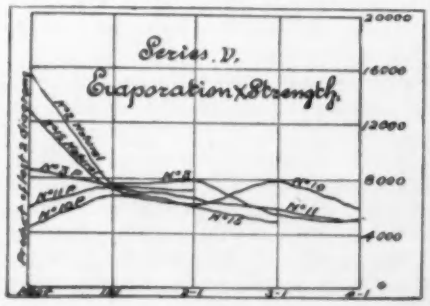
No. 2 — NATURAL.

| Mixture. | Evap. per cent. in 2 days. | Crushing strength per square inch. | Product. | wt. | | |
|---|---|---|---|---|---|---|
| Neat. | 5.93 | 2575 | 15720 | 9.43 | 2072 | 758. |
| 1 to 1 | 10.32 | 703 | 7254 | 9.06 | 2016 | 359.9 |
| 2 to 1 | 8.93 | 810 | 7233 | 9.28 | 2057 | 352.6 |

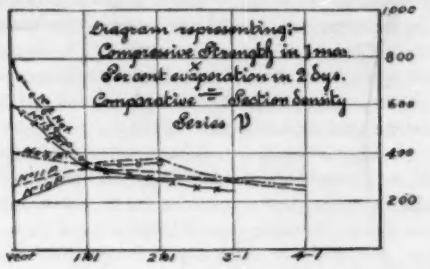
Reference to the table and diagrams will show that the evaporation increases and the strength diminishes with the increase of sand in the mixture. This is, of course, almost self-evident, but the striking difference in the amount of evaporation for different cements neat is unaccountable. This difference disappears as the admixture of sand increases, and we are led, therefore, to conclude that there is something inherent in the cement itself, which aids it more or less in holding particles of water in suspension. The natural cements show high evaporation neat, so also does the No. 3 Portland, which has a high specific gravity (see general tables), and the cubes of which weighed more than those of the No. 10, which evaporated least. We cannot account for it on the ground of Portland and natural, but one thing is evident, that that same quality which



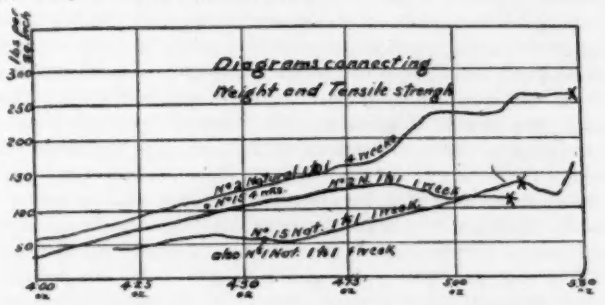




enables it to hold water in suspension also aids it in holding particles of sand together, but not particles of itself. The third diagram showing the convergence of lines on the 1 to 1 mixture is very striking. The *product* of the *crushing strength of a* 1 *to* 1 *mixture* and the *evaporation per cent.* under conditions named is practically CONSTANT. This is for one condition only, namely, 32 days, with access of water and 2 days' drying. This means in plain words that we may possibly be able to test with a balance instead of a crushing machine.

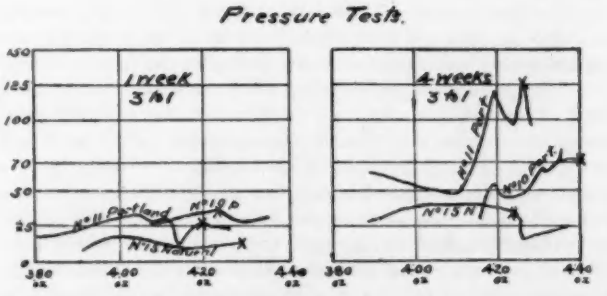



It is probable that the microscope would reveal a decided difference of structure in various cements. It is, of course, well known

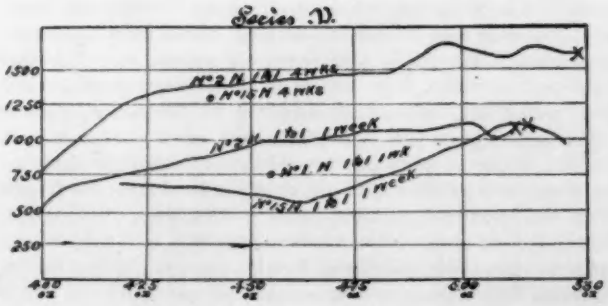
(*b*) *Evaporation and tension tests.*




that the underburnt natural cements have softer, rounder, and more easily pulverized grains than that produced by the highly burnt clinker of the Portland. It is possible, therefore, that the evapora-

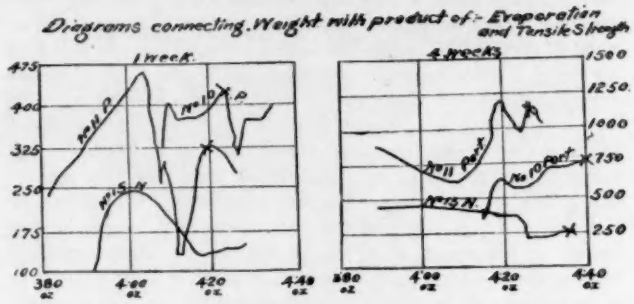



tion qualities of a neat cement would indicate more closely than anything else the degree of burning practised, independent of the fineness. It will be noticed by Table II., that the residues on sieves afford no clue to the density of the mixture, and no guide to determine beforehand the evaporation. Neither does the weight of the



specimens vary at all regularly either with the crushing strength or evaporation.

It would seem that the coarse, angular laboratory sand had its interstices just about filled up with a 1 to 1 mixture, and the strength of the mixture depended directly on the amount of evaporation, in an inverse ratio. The Evaporation diagram No. 4 is the same as No.

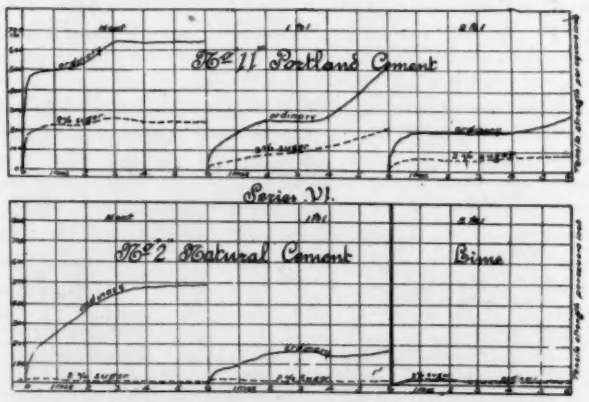



3, except that this product is referred to a uniform section density (*i. e.*) $\left(\sqrt[3]{\frac{}{weight}}\right)^3$ ; the diagram is practically the same, showing that the variation in weight of test pieces made practically no difference in the results, *i. e.*, the per cent. of evaporation determines the strength in 1 to 1 mixtures, but is no criterion in neat ones.

In Table III. and Table IV. the per cent. of evaporation in 2 days is again given, and diagrams are plotted showing the relation between the tensile strength and the weight of the dried briquettes in the pressure tests, and also other diagrams showing the product of tensile strength and evaporation plotted on a base of weights of briquettes.

The × marks in the diagrams show the positions of tests made with 20 lbs. pressure and 20 per cent. of water, and they are seen to stand at prominent and usually maximum points on the diagrams, proving that this is the best point to select of all the tests made.

It will be seen in these diagrams as in those of crushing tests,




that in 1 to 1 mixtures the variation of evaporation and strength combined is not very great, but not so close as in the former tests.

The 3 to 1 tests are very erratic, as might have been expected with different per cents. of water and different amounts of pressure. It is evident that each cement has distinctive qualities of its own, because with the same weight of briquette the strengths vary, and this brings up the important point that in sand tests the strength ought to be referred to some basis of weight of briquette, because a slight variation in weight seems, from Table IV., to affect the strength very much. It would not take much evidence to determine the average weight, and all tests could be reduced to this by multiplying by $\left(\sqrt[3]{\frac{}{weight}}\right)^3$ which would change the section density to a standard.

## SERIES VI.

### SUGAR TESTS.

Sucrate of lime is soluble in water, and it was chiefly a matter of interest to see the effect of sugar on cements in weakening them, because it has been asserted by several writers that the reverse is the case; one investigator several years ago showed by tests that from ½ to 1 per cent. of sugar would in 4 to 6 months give a gain in strength.

Sugar, in these tests, 2 per cent. of the amount of cement (by weight), was used, and the diagrams attached sufficiently indicate the results. In the Portland cement the strength ranges closely at 50 per cent. of the ordinary strength as far as 6 months, while with the natural cements, the sugar effect was overpowering. After 1 week's immersion the briquettes showed signs of cracking, and as time went on became completely checked, and expanded so much as to give practically no tests. This is further evidenced (see exhibit of briquettes) by the upper surface, which was protected by a coating of iron deposited from Montreal water, being intact, while the checking was greatest on the bottom where the water had free access.

The lime mixtures, kept in open air, showed encouraging results for 2 months, and seemed to prove that the use of sugar, in lime, as practised in India, was beneficial; but the 3, 4, and 6 months' tests disprove it. Altogether, it seems evident that this much or more sugar would be damaging in its effects on any kind of mortar in any situation, and it is extremely doubtful whether any sugar whatever would have other than a weakening effect.

In concluding this paper, the author cannot but help feeling that he is, as it were, dipping just on the surface of a vast subject, and that the more one finds out, the larger the unknown fields beyond appear.

In any efforts that have been made, the frequent manual aid and more frequent sound practical advice of Mr. J. G. Kerry have been of much service, and here is the place to acknowledge it.

The endeavor has been to find out anything of practical use to the engineering profession; and if any points raised here will fulfil this desire, the object of this paper will be, in the main, accomplished.

*(To be continued.)*

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## HEAT-RESISTING PROPERTIES OF PORTLAND CEMENT.

IN the "Digest of Physical Tests and Laboratory Appliances," Mr. J. S. Dobie gives particulars of the results of a recent investigation of the action of heat on Portland cement. Three different brands were examined, all of excellent quality, but two were of the slow-setting class, whilst the remaining one set very rapidly. Over two hundred briquettes were prepared, some consisting of neat cement, whilst in other cases one part of cement was mixed with one, two, or three parts of sand. The age of the briquettes ranged from two months to four years. In making the tests they were heated in a gas furnace to a temperature of from 650 degs. to 1,775 degs. Fahr. After removal from the furnace, every briquette was found to have lost weight, whilst in the case of the neat specimens, cracks were usually to be observed. These latter were less apparent in the case of the other briquettes containing sand. After cooling, the briquettes were tested for tensile strength with a load applied at the rate of 400 lbs. per minute. In all cases a marked decrease in the tensile strength was noted, which was apparently closely connected with the loss in weight of the sample. In those cases in which the reduction in weight showed that practically the whole of the water of crystallization had been driven off, the specimens had practically no breaking strength. The effect of different temperatures was, however, peculiar, since briquettes heated rapidly to 1,775 degs. Fahr. showed a loss of strength out of proportion to their loss in weight. When, however, the heating was slowly effected, these two losses were closely proportional. After cooling, the briquettes of neat cement could be crumbled to pieces in the fingers, whilst those containing sand disintegrated spontaneously on standing.—*British Clayworker.*

# The Masons' Department.

## THE ARCHITECT AND CONTRACTOR — IN GENERAL.

BY THOMAS A. FOX.

(*Continued.*)

MOST of the rules governing the honorable practise of the profession of architecture are the result of custom and usage. They are, therefore, much the same as should regulate all similar vocations, and are, consequently, so well known and understood as to need no particular attention or explanation. There is one condition of practise, however, affecting owner, architect, and contractor, which is almost always made mandatory, that is to say compulsatory, on the part of the architect, namely, that no architect shall accept "commissions." The constitution of the American Institute of Architects provides, and most of the other architectural organizations have a similar requirement, that "no fellow shall accept direct or indirect compensation for services rendered, other than the fees received from his client." Although there is no reason to suppose that this condition is often violated by those who belong to and practise under the regulations imposed by the various societies of architects, yet it must be admitted that an architect is often tempted by direct or indirect offers of commission, and it is fair to assume that such proposals would not be made unless they were sometimes accepted. In many instances violations of this rule have been known to exist, but it has been found impossible to prove the charge for the same reasons that it is always hard to prove bribery of other kinds, for such a transaction cannot be dignified by a term any less severe than this. Offers of commissions probably come of late more often from material men than from any other source, which is probably accounted for by the fact that competition has become so sharp that it is found hard to get even goods of merit on the market without resorting to some such measure, and also because commissions are now so generally offered and almost as often accepted with thanks in so many business transactions, that it is taken for granted that the architect will look with favor upon similar opportunities. The following circular, which has been lately framed by the Boston Society of Architects, to send to any one offering commissions, explains the case concisely and clearly, and it may be accepted also as defining the position of all architects who live up to the best principles of professional practise: —

"The enclosed communication has been received from you by a member of this society, offering a commission or special favors for the introduction and use of your specialties. Assuming, as is doubtless the case, that this is due to imperfect knowledge, on your part, of professional practise, allow me to point out that it is impossible for any reputable architect to receive commissions from material men for the following reason: The relation of the architect to his client is fiduciary, and the receiving of commissions which in the case of a business man might be perfectly legitimate is, in the case of the architect, in the nature of a bribe, as it leads him to favor certain materials for other reasons than his client's interests. On this account a by-law of this society provides that 'no practising member shall accept direct or indirect compensation for services rendered in the practise of his profession other than the fees received from his client.' In the hope that this information may lead to a change in your method of solicitation, which in the form referred to can only injure your interests with the class of architects whose approval you doubtless value, I am

"Respectfully yours, ——— ———

"Secretary Boston Society of Architects."

It can be seen from this circular letter that not only will the person offering a commission to an architect of standing fail to accomplish his purpose, but such action is liable to create a prejudice against both the individual and his material which will seriously affect the chances of their being favorably considered if at all. In this zeal to appear incorruptible many architects are inclined to treat offers of a commission much too harshly. In the case of a first offence on the part of a person who is presumably honest, it is only fair to assume that the offer was made under a misunderstanding of the conditions which should exist between the architect and those employed by him or under his direction. And in such instances, instead of making the person who offers a commission the object of his wrath, it would be much more profitable for the architect to first explain matters, and then find out what led the offender to think such a proposition was in order or would be entertained or accepted by an architect. An ingenuous way in which architects have been known to treat the matter of a commission, when they have learned that a sum for this purpose has been included in a bill for work or materials, has been to require the contractor to send a check for this amount to the owner, to whom, of course, the money rightfully belongs, for, as no one does work without profit, it is the owner who in the end pays all the bills, if they are paid at all. It is unnecessary to write at length on the subject of commissions; the facts in the case are clearly set forth in the two quotations given above, and the conclusions are self-evident. If a contractor or material man wishes the confidence and respect of the best members of the profession, he must depend entirely on the merit of his work or material. When he finds that offers of commissions or special favors are accepted, he may know that those who entertain such propositions, whatever may have been their professional standing in the past, are no longer to be considered as engaged in honorable practise, and he may rest assured that if any violation of the by-laws quoted above is brought to the attention of the officials of any society requiring its members to practise in conformity with such a rule, the offender will, if the evidence is satisfactory, be promptly brought to justice.

## HOW TO PREPARE MORTAR.

MR. EDWARD WOLFF, an American authority on the subject of limes and mortars, makes some very interesting suggestions relative to the proper method of slacking lime and preserving it in good condition thereafter. He says: —

"The slaking operation should be done in a water-tight box made of boards, and so much water should be mixed in that the contents will never get dry, and a sheet of water will remain on top to prevent access of air. If the box will not hold the entire quantity of lime required, the contents may be emptied into a cavity made in the ground close to the pan, and this process may be repeated. This should be done at least two weeks before sand is added, or before the mortar is prepared for use. Slaked lime prepared and kept as stated has been found free of carbonic acid after many years, air and gas not having been able to find access.

## RELATION OF COLOR TO QUALITY OF CEMENT.

MUNICIPAL ENGINEERING replies to the question, Has the color of cement anything to do with its quality? as follows: —

"As a rule, no. If a cement is very light colored, it is well to test it for strength, also for lime or possible adulteration with clay.

"If the cement is very dark, lampblack may have been added to deceive. Test for lampblack by dissolving in water, when, if present, an oily black film appears on the water. Lampblack of itself does no harm, more than to deceive ignorant buyers who think 'good dark color means good strong cement.' Color, smell, and feeling have very little to do with the value of a cement. Tests made with briquettes in tension are sure indicators of its value.

"It is surprising how many contractors and even cities trust entirely to the 'brand,' the manufacturers, or even the contractor, for a good cement. Cement tests are quickly and cheaply made, and should never be omitted in public or private important work."

# Recent Brick and Terra-Cotta Work in American Cities, and Manufacturers' Department.

PHILADELPHIA.— Architecturally, at present, all eyes are turned to the exhibition of the T Square Club, held in connection with the sixty-sixth annual exhibition of painting and sculpture of the Pennsylvania Academy of the Fine Arts; this exhibition so totally exceeds anything of its kind ever held in Philadelphia that it has excited unusual comment, indeed we would have scarcely believed that the general public were sufficiently interested in architecture to give serious cognizance to an architectural exhibition. Such exhibitions are generally considered as dry, mechanical, and artistic blendings of ideas which the layman cannot comprehend without a great deal of effort, and they are consequently very little patronized; this has, however, been an entirely different affair, for — whether by the foresight of the committee or by accident, we know not — there have been shown in conspicuous positions many beautifully executed drawings in which the public at the present time are directly interested, and around these have been grouped many others, less interesting to the public by reason of their being from other cities, but withal, beautiful, interesting, and comprehensive. It is, without doubt, the finest collection which has ever been exhibited in this city, and the general study and attention which has been given it will undoubtedly advance the cause of artistic design very considerably. As this is the very matter which the members of the T Square

Club have for years been endeavoring to accomplish, it can be truthfully said in this instance that they have made decided progress this year, and gone a long step forward. It is to be hoped that they will carefully follow up the advantage thus gained, and by many more such events bring the architect, builder, and layman in closer touch than heretofore.

Of new work in prospect much might be said, as once again there are rumors of large undertakings; nothing, however, has taken definite shape except the work upon the new M which was begun a short time ago. The excavations are being pushed to the utmost, and it has been announced that the foundations and superstructure will follow immediately.

As if to decide quickly the question as to whether there shall

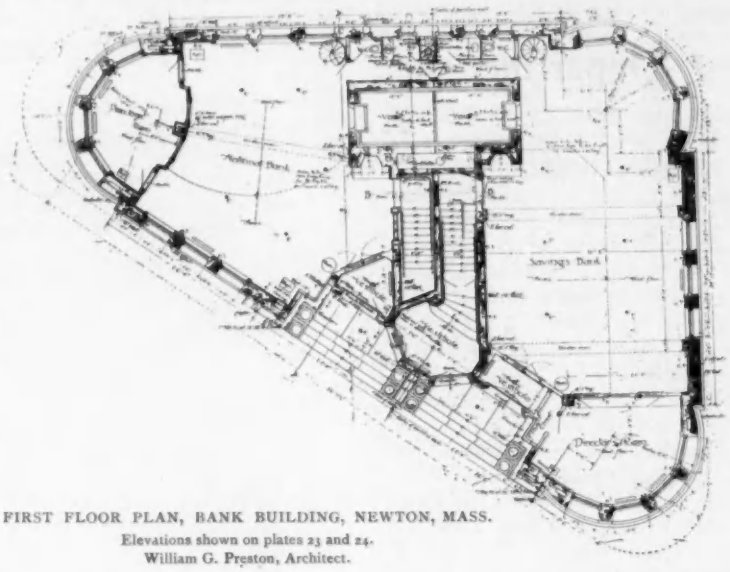
BUILDING FOR Y. M. C. A., 8TH AVENUE, NEW YORK.
Parish & Schraeder, Architects.
Built of gray brick and terra-cotta made by the Excelsior Terra-Cotta Company.

or not be a plaza in front of the city hall, came the disastrous fire of a few weeks ago, which practically destroyed every building in the block fronting the city hall on the northeast. This is one of the very blocks which the advocates of the plaza project have been endeavoring to have the councils condemn for that purpose, and the destruction of the buildings will now compel them to decide once for all whether it shall be done. It is obvious that there will never be another such an opportunity offered, and should councils fail to act now, the plaza project will undoubtedly be a thing of the past, and be shelved with the boulevard and other like propositions. There seems, however, to be a decidedly outspoken sentiment in favor of the project at the present time, and an ordinance has been drafted and published, for submittal to councils at their next session, which, if passed will at once clothe the proper authorities with power to take the preliminary steps in the condemnation proceedings, and it is not unlikely that the long-wished-for time has arrived when the city hall will be at least partially relieved from the danger of being entirely pent up upon all sides with sky-scraping buildings. If condemnation proceedings do not issue at once, active preparations will be made to immediately rebuild the destroyed portions.

Bids have been asked for the erection of a building on the corner of 7th and Sansom Streets, for the Philadelphia *Press;* the building will be 38 by 91 ft. in size, ten stories high, steel frame with brick walls, and stone and terra-cotta trimmings, fire-proof floors, etc. The drawings are by Theophilus P. Chandler, and the work of construction is to commence at once. It is said that as soon as this building is completed the Chestnut Street front of the lot will be cleared and rebuilt to conform with the work now being commenced.

Messrs. Cope & Stewardson have completed the preliminary drawings for the Pennsylvania Institution for Instruction of the Blind, which will be built this summer at Overbrook, one of the most beautiful of the newly laid out suburbs of this city; the building will be very large and commodious, will be built somewhat after the manner of the monastery, and will consist of a central administration building with reception and executive departments, and two wings, cloisters for girls and boys respectfully. The material for the building will be stone, plastered and pebble-dashed on the exterior, with trimmings and columns of terra-cotta, set in position by the stone-mason. Bids for the work will shortly be asked.

A very pretty alteration by Keen & Mead, architects, shown in the accompanying illustration, is situated on the corner of 15th and Jefferson Streets, is of Pompeian brick with red stone trimmings, the tympanum of the arches being of colored plaster, with small colored shields.



FIRST FLOOR PLAN, BANK BUILDING, NEWTON, MASS.
Elevations shown on plates 23 and 24.
William G. Preston, Architect.

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ST. LOUIS. — At the present time there seems to be considerable energy back of the proposition to cut Locust Street through the Exposition Building from 13th to 14th Street. Should this be done, the scheme to give us a place in which to hold large meetings will necessarily be abandoned for the present, at least, as the proposed amphitheater was to be located in the north wing of the Exposition Building.

The property upon which the Exposition stands was given to the city years ago to be used perpetually as a public park, and was leased to the Exposition for fifty years, and the question as to whether a street can be cut through the property will doubtless have to be passed upon by the courts.

Churches have been among the many improvements that the growth of our city and the migration of the wealthy have made necessary. Last month three large churches were dedicated within eight days: The Lafayette Methodist Episcopal Church, the Lindell Avenue Methodist Episcopal Church, and the Jewish Synagogue for Shaare Emeth congregation.

The old Lafayette Church was a victim of the cyclone last May, and in the rebuilding the seating capacity has been more than doubled to meet the demands, and provisions have been made for addition in the future.

Messrs. Link & Rosenheim were the architects of the Lindell Avenue Church and the Synagogue, and in the latter they have designed a building to meet the modern requirements and advanced thought of the Jewish Church. Past traditions and customs have influenced them but little, and there is nothing to distinguish it from its near Protestant neighbors.

Besides the above mentioned there are a number of other large churches under contemplation, some of which will doubtless assume definite shape soon.

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CHICAGO.— It is too early for spring building and there will probably not be much of a rush this year. Business is indeed dull. Some architects who have been important factors in Chicago work say that they have done nothing for a year or more.

The items of most importance just now seem to be warehouses, of which about half a dozen are in progress. Mr. Dankmar Adler has two to build, one 80 by 100 ft., nine stories high, and the other 50 by 100 ft., eleven stories. Pile foundations will be used, and the general construction will be, at least partially, fire-proof.

One announcement is that Greifenhagen & Kingsley are designing an apartment building exceeding $100,000 in cost.

Dwen & White are directing work on the McCoy Hotel, which is to be remodeled at considerable expense.

J. H. Wagner is the architect of a $60,000 shoe factory, which is just beginning construction.

AUBURNDALE PUBLIC SCHOOL BUILDING, TOLEDO, OHIO. — F. O. FALLIS, ARCH'T, MASBY TOWER, TOLEDO, OHIO.

PITTSBURG.—As the winter months are coming to a close business in the architectural and building lines is livening up considerably, and much work is talked of and planned for the coming season. The Central Board of Education has settled on two

NINTH PRECINCT POLICE STATION, BROOKLYN, N. Y.
Frank Freeman, Architect.
Architectural terra-cotta made by the New Jersey Terra-Cotta Company.

sites for the proposed sub-high schools one in the East End and the other on the South Side.

An ordinance has been prepared for an appropriation for the erection of an isolation hospital in this city, to accommodate one hundred patients, and to cost between $150,000 and $200,000.

Architect F. J. Osterling will prepare plans for an insane asylum, an addition to the Allegheny City Home at Claremont, to cost $60,000.

It is rumored that the Pennsylvania Railroad Company is contemplating the erection of a new station at East End, to be of brick, and cost about $75,000.

Architects J. E. Carlisle & Co. were the successful competitors out of ten of the leading architects of this city for the new school building at Turtle Creek. It will have sixteen rooms, be fire-proof, and cost $40,000.

The First Presbyterian congregation of Wilkinsburg is contemplating the erection of a church building, to cost about $30,000.

Architect F. C. Sauer is preparing plans for a new parochial school building for the St. Joseph's Church at Allegheny.

It is reported that Mrs. Mary Kaufman will erect about thirty houses along Fifth Avenue, Walnut, and Howe Streets. They will cost from $7,000 to $12,000 each.

Architect T. D. Evans is preparing plans for a residence for Geo. Bennett, Esq., to be erected on Fifth Avenue, Bellefield, to cost $30,000.

Architect Thomas Boyd has prepared plans for a Pompeian brick residence at Beaver, Penn.

Architect Edward Stotz has prepared plans for a new town hall at Sistersville, W. Va. Mr. Stotz was the successful architect in the competition for the People's National Bank to be erected at McDonald, Penn.

Homestead is agitating the question of erecting a new town hall.

Bradford is contemplating the erection of a public building, to cost $60,000.

There will be considerable building at Turtle Creek the coming spring and summer.

Westmoreland County will invite architects to submit plans for a new court house.

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MINNEAPOLIS.—We are in the midst of our midwinter dulness, with more or less of uncertainty staring us in the face as to what the spring will bring forth. We have reason to believe that it will be a material improvement over last spring, both in the amount and character of the work to be done.

It is understood that our Chamber of Commerce will not erect a new building, but will cover their present lot with an addition, to cost approximately $50,000. Architects were hoping that a well-conducted local competition would spring from the erection of a new building. The present one is such an eyesore and so inconvenient that a new and more representative structure is devoutly wished for by those interested in our city artistically.

Architect George E. Bertrand has begun an education of the public on good architecture, and has presented some very tasty designs for the various problems arising in general practise, showing the adaptability of Greek models to our present needs. Let us hope his labor may not be in vain.

Two of our leading architects have turned their attention to the manufacture of acetylene gas, each having devised a generator that is superior to the others, and formed stock companies, and disposed of territory, etc. They will certainly find it more profitable than architecture, as it is practised in these parts. An architect, to be thoroughly conscientious and dignified, must either be independent or be content with a bare existence.

A medical building to be operated in connection with Hamline University by Minneapolis College of Physicians and Surgeons; cream brick and cut stone trimmings, and to cost about $50,000.

Governor Clough has recommended a prison for women, to be located near the twin cities, and to cost approximately $100,000.

Among the larger enterprises of the month may be mentioned

MONMOUTH COLLEGE AUDITORIUM BUILDING, MONMOUTH, ILL.
D. E. Waid, Architect.

school buildings at Waterloo, Ia., and Kaukauna, Wis., by Orff & Joralemon. The former 68 by 108 ft., 8 rooms, of Gladbrook brick, cost, $30,000. Latter, 80 by 100 ft., 12 rooms, of brick with slate roof, cost, $50,000.

Flat building on Dayton Avenue, St. Paul, planned by F. A. Clarke, 18 apartments, to cost $75,000.

A bill has been introduced into State legislature calling for an inebriate department at Rochester Insane Hospital, to cost $50,000.

There is an effort being made to so shape legislation as to allow of completing our new Capitol Building within a reasonable time, and permit of a saving of from $20,000 to $50,000 dollars. There seems to be a disposition to use the full ten years contemplated by the bill, but those conversant with the matter hope that it may be put through in a more business-like manner and within a reasonable time, say by the time our next session of legislature sits, two years hence.

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THE International Correspondence Schools of Scranton, Penn., have been in existence less than six years, but have amply demonstrated their reason for being by drawing pupils not only from Pennsylvania, but also from all over this country and from several foreign lands. We have received the Circular of Information of the Correspondence School of Architecture, which covers only one of the many branches in which instruction is offered. The method of these schools is implied by their name, and while they are not as far reaching as our higher technical schools and colleges, they are certainly a boon to the busy man; to the poor artisan who seeks to better himself; to the engineer in charge of a power plant, who feels the lack of education; and to the aspiring office boy in a busy architect's office, who wants to rise but cannot afford a college education. They offer a substitute, but a most excellent one, and to judge by the sample pages of instruction papers, the fifty dollars invested in one of the scholarships, if followed by a couple of hours of daily application, would certainly result in vastly enlarging one's powers, even if it did leave a few architectural facts and experiences still to be acquired.

BOHEMIAN CLUB HOUSE, EAST 71ST STREET, NEW YORK CITY.
Julius Franke, Architect.
Built of gray brick and terra-cotta made by the Excelsior Terra-Cotta Company.

## NEW CATALOGUES.

THE STANDARD DRY KILN COMPANY, Indianapolis, Ind., present their case in one of the handsomest and best gotten up catalogues that has ever come to our notice. The covers are bound in leather, padded in album style; in fact, it is nothing less than an album, containing as it does some forty or more fine half-tone illustrations of large clay-working plants in this country. These illustrations are accompanied by testimonial letters from manufacturers, which must be accepted as conclusive evidence of the worth of the dryers and various other clay-manufacturing appliances which are made by this company. We presume this catalogue will be sent to any one upon application to the company, and certainly it should be possessed by every one interested in the manipulation of clays.

THE CUTLER MANUFACTURING COMPANY, Rochester, N. Y., have issued another interesting number of their series, entitled, "Details from Italian Palaces," measured and drawn by Claude F. Bragdon. The enterprise shown by this company in giving a series of sketches of subjects that have not been "published to death" is refreshing and commendable.

THE half-tone process as a means of effective illustration is being made good use of by the Chambers Brothers Company, Philadelphia, in a series of pamphlets, showing their various patterns of brick-making machinery. The latest which has come to our notice shows two pugging mills and a clay disintegrator, in a manner that leaves little to be desired.

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## PRESS-BRICK CONVENTION.

THE annual convention of the general managers of the various branches of the Hydraulic Press-Brick Company of St. Louis was held in that city, beginning with Monday, February 8, and was continued for several days.

The various plants of the company, located in nine different cities, were represented by their general managers.

These yearly gatherings are important to the company from the fact that they bring together representatives of leading industries, covering a large section of the country. The reports of the managers of the general conditions prevailing, as made at the meeting, declare that the outlook for the coming season is very much better than has been experienced in the past two years, and a general revival of the building interests may be fairly expected. Mr. E. C. Sterling and Mr. H. W. Eliot, as president and secretary, respectively, of the parent company, hold the same offices in the various branch companies, and the proceedings of the convention are conducted under their direction. The combined product of the companies represented by these gentlemen, it is said, now amounts to more than 300,000,000 pressed bricks annually, and the capital invested in the various companies exceeds $13,000,000. Mr. G. F. Baker has had charge of the arrangements of the convention, to whom, as well as to the other officers of the company, the success of the meeting was largely due.

Among the interesting subjects for discussion was the "Chemistry of Clays," on which a very able address was made by Mr. W. M. Chauvenet, in which he took up this very broad question, and explained the characteristics of the large number of clays worked by companies in all sections of the country, in their relation to the actual manufacture of bricks. The address was unique, as being probably the most practical lecture on the subject ever given before a similar body.

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## A NEW THING IN BRICK.

WE have had brought to our notice a novel production by the well-known manufacturers of fire-proof building material, Henry Maurer & Son, 420 East 23d Street, New York City, and believing the same will be of interest to our readers, we give a few of the claims made for it by the manufacturers.

It is a brick which they have named the "Centaur," patented in the United States, Great Britain, Canada, and France, and is claimed to possess the following characteristics: —

It is absolutely fire-proof, yet, while seemingly as hard burnt as a front building brick, and nearly as dense, has the peculiar quality, and one heretofore deemed impracticable in a brick of allowing nails, to be driven into it as closely as one pleases, without either splitting or chipping, and the tenacity inherent in said material is such that after being driven "home" it becomes as difficult to draw the nails as though driven into hard wood.

They are impervious to all weather, and will not disintegrate upon exposure, a failing hitherto associated with porous terra-cotta.

They can be employed jointly with common brick on inside of walls in any and all cases where nailing is requisite, providing a thorough and reliable surface for nailing furring strips to the wall, giving also excellent "grounds" for all trim (hard or soft).

If these claims are substantiated, and we have no doubt they have been, it becomes readily apparent that their use will make a great saving in time, labor, and expense in construction, to say nothing of their other novel features.

## INTERESTING NEWS ITEMS.

MESSRS. G. R. TWICHELL & Co. have been appointed the agents of the New Jersey Terra-Cotta Company for New England.

THE AMERICAN MASON SAFETY TREAD COMPANY has made a contract with the city of Boston to apply its non-slipping material to the worn granite steps of all police stations.

THE PERTH AMBOY TERRA-COTTA COMPANY will supply the architectural terra-cotta used in the residence for George J. Gould, Esq., at Lakewood, N. J., of which Bruce Price is the architect.

THE face brick used in building the Yerkes Observatory at Geneva, Ill., were gray in color and not buff, as stated in our January number. They were furnished by the Columbus Brick and Terra-Cotta Company, Columbus, Ohio.

THE new cream-white brick made by the Pennsylvania Enameled Brick Company are a solid body mud brick that give a true ring when rapped with a hammer. Meeker, Carter, Booraem & Co., New York, will handle the output of these bricks.

G. R. TWICHELL & Co., Boston, are supplying an old-gold face brick for the new hotel at Providence, R. I., for which Cady & Co. are the architects. They are also supplying a gray brick for the new block of stores on Massachusetts Avenue, Cambridge, C. Herbert Clare, architect.

THE PERTH AMBOY TERRA-COTTA COMPANY have closed contracts for terra-cotta for the following buildings: Hotel Cheltenham, A. H. Bowditch, architect; Gardiner H. Shaw, builder. Office building, Washington and Bromfield Streets, Winslow & Wetherell, architects; the Geo. A. Fuller Company, builders; both contracts being made through their Boston agents, Waldo Brothers.

WALDO BROTHERS have secured the New England agency for the Atlas Cement Company. This company is enlarging its plant at Northampton, Penn., and will have the largest output of any of the American Portland Cement companies. They will continue to have but one brand and one quality, every barrel of their output carrying a specific guarantee for strength and fineness.

SUCH an indorsement as is given in the following letter, received by the Folsom Snow Guard Company, from F. W. Chandler, Esq., Professor of Architecture, Massachusetts Institute of Technology, and consulting architect on Boston public buildings, is of value, not only to the favored manufacturer, but to the architect and builder as well.

*To Whom it may Concern:* I have often used Folsom Snow Guards because I consider them better than the rail. The former hold the snow where it falls, while the latter makes the snow bank up with the consequent danger of back water and a wet interior.

F. W. CHANDLER.

THE ZANESVILLE MOSAIC TILE COMPANY have closed the contract through their agents, O. W. Peterson & Co., Boston, for the tiling in the five-story apartment house on Westland Avenue, Boston. Arthur H. Bowditch, architect.

The contract includes the tiling of twenty bath rooms, two porches, two vestibules, two main halls, and twenty fireplaces. The tile selected for this work is designated by the company as the Parian Vitreous Tile, of which they are the sole manufacturers.

THE STANDARD TERRA-COTTA COMPANY have secured through their agents, O. W. Peterson & Co., Boston, the terra-cotta to be used in the Masonic Temple, Pawtucket, R. I., Wm. R. Walker & Son, Providence, R. I., architects; W. T. Dearborn & Son, contractors.

They have also closed the contract for the terra-cotta (gray) to be used in the Odd Fellows' Building, Attleboro, Mass., Alfred Humes, of Pawtucket, architect; Benj. Smith, contractor; and the contract for the terra-cotta (light buff) to be used in a business block now being erected in Pawtucket, R. I., Wm. R. Walker & Son, Providence, R. I., architects; Benj. Smith, builder.

MEEKER, CARTER, BOORAEM & Co. have recently secured two contracts for furnishing the University Library of Columbia College. One contract calls for some sixty thousand brick, including a large number of special brick for the base course in the hall and stairways of the library. These will be furnished by the American Enameled Brick & Tile Company, who are expert at making special brick.

The second contract calls for the furnishing of some thirty odd thousand pure white front brick for the same building, from the output of the Pennsylvania Brick Company, for whom they are agents.

The architects of this work are Messrs. McKim, Mead & White. The builders are Messrs. Norcross Bros.

THE NEW JERSEY TERRA-COTTA COMPANY has now completed the terra-cotta work for the Y. M. C. A. building at Cambridge, Mass., and Masonic Temple, Newton, Mass., Hartwell, Richardson & Driver, architects; the Ninth Precinct Police Station, New York City, John Du Fais, architect; and the Osterweis Building, New Haven, Conn., Brunner & Tryon, architects.

Of new contracts this company has received: stores 37th Street and Broadway, New York City, Hoppin & Koen, architects; warehouse, 455, 457, 459 West 14th Street, New York City, Thos. R. Jackson, architect; apartment house, Pineapple and Hicks Streets, Brooklyn, J. G. Glover, architect; chapel and lecture hall, Van Nest, N. Y., James H. McGuire, architect; apartment house, 65th Street, New York City, Geo. Keister, architect.

W. S. RAVENSCROFT & Co. have recently purchased the village of Daguscahonda, Penn., together with a large clay bed of several hundred acres which adjoins the town. The property was purchased for the purpose of developing the clay deposits located there, and the company are at the present time equipping a large plant for the manufacture of front brick, by the most approved methods. The character of the clay gives them quite a range of color in the variety of bricks produced, varying from the dark mottled shades to old gold, light buff, and the various effects of gray. The company state that it is their intention to make a specialty of their gray and buff bricks, as they have been able to produce particularly desirable shades in this respect, and anticipate that the demands on these two lines alone will equal the capacity of their plant. These bricks are similar to the well-known Ridgway gray and buff that have won such extensive favor during the past two years. The two plants are only a few miles distant from one another, and the clays are said to be identical. The town of Daguscahonda is situated on the Philadelphia and Erie branch five miles east of Ridgway. Mr. Ravenscroft organized and built the Shawmut and Ridgway plants, and is still a stockholder in the last-named company. He is also a director in the Savage Fire Brick Company of Keystone Junction, Penn.

## EVOLUTION IN BRICKMAKING.

BURNT clay is the oldest and most primitive of all building materials, and has been used for untold centuries in much the same manner as we use it to-day. But although bricks have always been fashioned out of clay, the evolution from the primitive brickyard, with its crude appliances and laborious manual devices, to the modern plant, with its highly organized mechanical equipment, is a development of the past two generations, and brickmaking at the close of the nineteenth century can be classed as an exact science, representing results of long and costly experiments, and calling for investments of capital and vastness of operations on a plane with the largest of American enterprises. The extent of the development of brick manufacturing is well illustrated by the plant of the Sayre & Fisher Company, at Sayreville, N. J., which was originally established in 1851, by Jos. R. Sayre, Jr., and Peter Fisher, who remained in partnership until 1887, when the firm was incorporated as a stock company, with Jos. R. Sayre as president, Peter Fisher as treasurer, and E. A. Sayre as secretary, and has continued since that time without any change in the management. The manufacture of brick was begun at this plant in 1852. Only 3,000,000 common bricks were produced the first year, whereas in 1896, 73,000,000 bricks of all kinds were turned out, and the daily consumption of clay and sand, which in 1852 was about 75 tons, rose to 1,000 tons in 1896.

The company controls over a thousand acres of clay beds. A force of from six hundred to eight hundred men is employed in buildings which are fully equipped with modern machinery, exclusively devoted to the manufacture of brick, and extend along the full length of the frontage on the Raritan River, with a wharfage a mile in total length, from which the output is shipped directly by water or by rail to any part of the world. All the Sayre & Fisher common bricks are made by the soft mud process, while the stiff mud process is used for front bricks, the regulation machinery being utilized for each.

As the front bricks are the ones in which most of our readers are presumably the more interested, we would briefly explain the stiff mud process as follows. The clay, after being thoroughly seasoned, is mixed dry, then run through crushers, where it is pulverized, then through a "wet" mixer, where it receives additional mixing, then through a die, to form the clay into the proper shape for cutting, thence being delivered to a machine which cuts it into bricks of the required thickness. The bricks so formed are then subjected to a heavy steam pressure, then dried by hot air, then burned in the kilns. The ordinary down-draft kilns are used, of which there are sixty-three in all, with a capacity running from 30,000 to 600,000 bricks, the average capacity being about 300,000 bricks. The process of manufacturing is in every way facilitated by the adoption of the best approved machinery, every stage of the work having its particular appliance. From the loading of the clay on the cars by the steam shovel to the transfer of the burnt bricks from the kiln there is everywhere employed the best possible device to save labor, and with a view to still further economy of labor the company has recently, at a great expense, equipped its entire plant with electricity.

THE QUEEN INSURANCE COMPANY'S BUILDING, CEDAR AND WILLIAMS STREETS, NEW YORK CITY.
W. A. & F. E. Conover, Contractors. Harding & Gooch, Architects.
Brick furnished by Sayre & Fisher Company.

The clay banks of the company contain no less than eighteen different kinds of clays, and hence it can produce a great variety of shades in brick, not by artificial coloring matter, so apt to fade, but by the careful selection, intermixture, and burning of the clays. The annual output of the plant is over 73,000,000 brick. Of this some 64,000,000 are common, and the remaining 9,000,000 face and enamel brick.

The Sayre & Fisher Company was among the first, if not absolutely the first company, to offer a variety of shades in brick. The first departure from the ordinary "red" was a gray buff, which was put on the market in 1863. This was the first buff brick made in New Jersey, and used to easily bring sixty dollars per thousand. The company at the present time is making white, buff, red, gray, brown, old gold, mottled, and all the intermediate shades of brick, and these have acquired for themselves an enviable reputation for holding their color and being hard and fire-proof in character.

The enamel brick department is of a size and character in keeping with the vast proportions of the rest of the plant. The method employed here is what is known as the English process, wherein the enamel is placed on a fire-brick body and burnt with one firing. The number of shades which the company manufactures and keeps in stock, as illustrated in their catalogue, is over twenty-eight. This gives a wide range for selection in the choice of color.

Nearly all of the machinery used in the works is manufactured by the company in a large machine shop of its own. All of the departments are kept in the most thorough working order, so that the vast organization operates with a smoothness and uniformity which makes possible the uniform excellence of the output. The attention to detail which the company shows is evinced in the consideration given to the men in its employ. Among its thousand or more employees there is a large proportion of single men, and for their benefit the company has erected a large building which is to all intents and purposes a regulation club house, in which the men can sleep and have their meals, and where they can enjoy, with some necessary restrictions, all the comforts and privileges that men desire in a well-equipped club.

The New York office of the company has been since its establishment, seven years ago, under the efficient management of Mr. A. J. Fletcher. The large and ever-increasing sales in the New York market, of brick made by this company, testify to the genuine merit and popularity of the output, combined with the energetic and conscientious management of the department through which this output is sold. The company has branch offices in Baltimore, Philadelphia,

BOWLING GREEN BUILDING, NEW YORK CITY.
W. & G. Audsley, Architects.
White brick furnished by the Sayre & Fisher Company.

Buffalo, Newark, Chicago, and Boston, and in all of these cities the number of Sayre & Fisher bricks used annually is rapidly increasing. and deservedly so.

The list of large and prominent buildings in which Sayre & Fisher bricks have been used is so long that we can only cull from it a few of the most well-known structures.

NEW YORK.

| | |
|---|---|
| Bowling Green Building | 800,000 white brick. |
| Cable Building | 500,000 " " |
| Bank of Commerce | 400,000 cream-white brick. |
| Lord's Court Building | 500,000 gray brick. |
| Central National Bank Building | 300,000 " " |
| St. Luke's Hospital | 300,000 white enameled brick. |
| American Surety Building | 80,000 " " " and 115,000 light-gray brick. |
| Presbyterian Building | 40,000 white enameled brick. |
| Manhattan Life Building | 140,000 buff brick. |
| Mutual Life Building | 160,000 " " and 40,000 gray brick. |
| The Dakota Apartment House | 360,000 buff brick. |
| Colonial Club | 60,000 " " |
| Museum of Natural History | 30,000 " " |
| Life Building | 30,000 " " |
| Metropolitan Museum | 200,000 " " |
| Fifth Avenue Theater | 25,000 " " |
| Manhattan Athletic Club | 80,000 " " |
| Residence of Mrs. W. K. Vanderbilt | 45,000 mottled brick. |
| Central Building | 250,000 old gold " |
| Taylor Building | 185,000 " " " |
| Postal Telegraph Building | 160,000 gray brick. |

BOSTON.

| | |
|---|---|
| State House Extension | 200,000 buff brick. |
| Castle Square Theater | 120,000 white brick. |

In a general way it can be said that the Sayre & Fisher bricks are used very largely throughout the Eastern, Middle, Western, and Southern States.

A very good view of the company's extensive plant is shown in their advertisement on page xvii.

# INDEX TO ADVERTISEMENTS.